AF / XPXC

AIR FORCE TOOLBOX

Toolkit Name: Sea Viking 04

Toolkit Date: 05-17-2004

Current Toolkit: No

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Space Lift and Space Control

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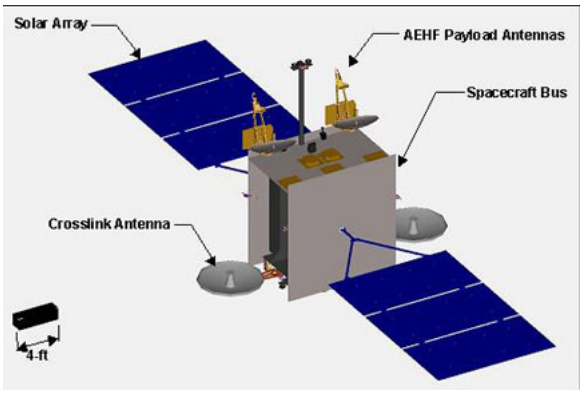
System: Advanced Extremely High Frequency (AEHF) Satellite System



Category: C4ISR
Function(s):
Command and Control

Long Description: The Advanced Extremely High Frequency (AEHF) Satellite System is a joint service satellite communications system that provides secure, jam-resistant, long-haul, and worldwide communications for high priority military users. The system consists of four satellites in geosynchronous earth orbit (GEO) that provide 10 to 100 times the capacity of the 1990s-era Milstar satellites. Assuming a full constellation, this provides continuous 24-hour coverage between 65 degrees north and 65 degrees south latitude. These systems provide global, secure, jam-resistant communications capabilities to ground, sea, and air assets. AEHF allows the President, Vice President, SecDef, and CINCs to control their tactical and strategic forces at all levels of conflict up through the early stages of general nuclear war and supports the attainment of information superiority.

AEHF provides natural jam-resistance, a function that is further enhanced by processing techniques on board the spacecraft that allow communications to be independent of ground relay stations and ground distribution networks. Automatic management of the satellite communications network allows services to be established in minutes. AEHF also allows use of smaller and more mobile terminals installed on aircraft, ships, and land vehicles. Man-portable systems are also available.

The AEHF system is composed of three segments: space (the satellites), terminal (the users), and mission control. The space segment consists of a cross-linked constellation of satellites to provide world wide coverage. The mission control segment controls satellites on orbit. It performs satellite health maintenance, satellite constellation control, and communications management. This segment is highly survivable, with both fixed and mobile control stations. The terminal segment includes fixed and mobile ground terminals, ship and submarine terminals, and airborne terminals.

Limitation:
- Susceptible to radio frequency, electromagnetic pulse, anti-satellite weapons, and information warfare attacks
- Constrained launch infrastructure inhibits rapid reconstitution of AEHF constellations
- Datalinks and platform susceptible to space weather-caused outages and anomalous behavior

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Performance

Category(ies)	Data
Capability	Data rate communications (voice, data, teletype, and facsimile) at 75 bps to 8.192 Mbps Capacity of 1.6 Gbps Worldwide coverage from 65-deg N to 65-deg S lattitudes
Endurance	Design lifetime of 10 years
Launch Platform(s)	Medium EELV
Orbit	22,400 nm (41,484 km) (GEO-synch)
Other	Terminal interfaces with: Airborne Command Post Terminals and Ground Command Post Terminals (support 75 - 1544 kbps data rates) Ground Force Element Terminals Ground Transportable Command Post Terminals Airborne Force Element/C2 Terminals (terminals support 75bps - 2400 bps data rates)

System: Advanced Narrowband System (ANS)

PHOTOGRAPH NOT AVAILABLE

Category: C4ISR
Function(s):
Air Refueling

Long Description: The Advanced Narrowband System (ANS) provides voice and low-speed data service to mobile users.

The program using demand assigned multiple access (DAMA) technology provides SATCOM connectivity to airborne platforms and high-priority single channel ground-to-ground connectivity. Some users will augment/replace UHF follow-on (UFO) capability with emerging commercial services.

Multiple commercial, single-user systems will become available to provide Mobile Satellite Services (MSS). MSS is a DISA initiative to provide commercial narrowband services to DoD users. These commercial systems include Globalstar, International Maritime Satellite, Teledesec, etc.

DoD narrowband users will migrate to JTRS-compliant radios and terminals.

Limitation:

Performance	
Category(ies)	Data

System: Advanced Wideband System (AWS)

Category: C4ISR
Function(s):
Counterspace
Missile Defense

Long Description: The Advanced Wideband System provides high-capacity, high-speed voice and data communications services for fixed and deployed forces worldwide.

The Global Broadcast Service (GBS) provides higher bandwidth to satisfy Air Force and Joint information dissemination requirements. The entire Advanced Wideband System is complete in 2015, and includes five advanced satellites in GEO orbit and three residual gapfillers. Since 1999, GBS Phase II packages are hosted on three UHF Follow-on (UFO) satellites. Commercial multi-user Ku and C band satellites are available for DoD use and commercial Ka band became available in 2001 - 2003. The DoD Teleport provides connectivity for interface between airborne platforms and ground networks (DISN). The Wideband Gapfiller System (WGS) is a "commercial-like" satellite communications system that augments the Defense Satellite Communication System (DSCS) satellites and Global Broadcast Service (GBS) payloads on Ultra-High Frequency Follow-On (UFO) system satellites.The WGS constellation will consist of six satellites, based on the Boeing 702 satellite body, and can carry up to 118 high-power transponders.

Limitation:
- Not nuclear hardened
- Limited jamming protection (no nulling) - although narrow beams help to avoid jammer locations

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Performance

Category(ies)	Data
Capability	X-band: up to 50Mbps per link Ka-band (2-way): up to 274 Mbps per link Ka-band (GBS): Up to 24 Mbps Crosslink: 1 Gbps Throughput per satellite: 4Gbps Ka and X-band crossbanding Hybrid payload with Internet Protocol (IP) capability
Coverage	20 flexible beams configurable from 1-degree to earth coverage.

Dimensions	Satellite Weight: ~6500 lbs 8' (W) x 8' (L) x 10' (L)
Other	Five GEO satellites Lifecycle: 15 years per satellite Launch Vehicle: EELV/RLV

System: Global Broadcast System

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Category: C4ISR
Function(s):
Command and Control

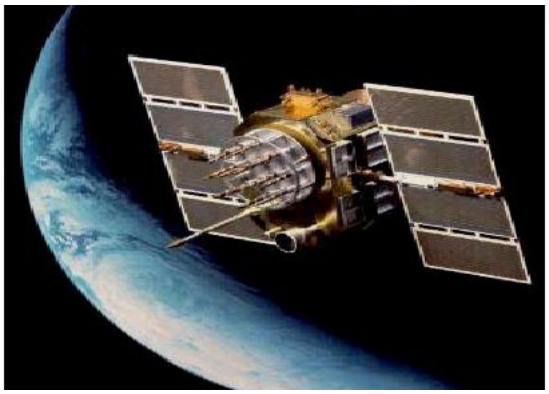
Long Description: The Global Broadcast Service (GBS) augments existing communications systems by providing high speed, wide-bandwidth one-way broadcast of information for simultaneous reception by multiple deployed, on-the-move, and/or garrisoned forces. GBS is integrated into the Defense Information Infrastructure to distribute high volumes of information worldwide. It interfaces with and augments other major DoD information systems. GBS is hosted on UHF Follow-on satellites and other wideband service satellites.

Limitation:
- Susceptible to Information Warfare/Electronic Warfare such as jamming, computer viruses, and denial of service attacks.
- Environmental disturbances (rain attenuation of signal, Electromagnetic Interference (EMI)/Radio Frequency Interference (RFI), Solar Storms, etc).
- Information sender does not know who is receiving the sent information.

Performance

Category(ies)	Data
Orbit	GEO and Polar hosted package
Other	Coverage: Global Coverage Satellites: UFO and other wideband service satellites

System: Global Positioning System III (GPS)



Category: C4ISR
Function(s):
Navigation and Positioning

Long Description: GPS is a constellation of 24 orbiting satellites that provide navigation data to military and civilian users worldwide. GPS receivers collect the signals from at least four GPS III satellites to provide 24-hour navigation services which include extremely accurate, three-dimensional (latitude, longitude, and altitude) location information, velocity, and precise time. The GPS system provides passive, all-weather operations; jam-resistant, continuous real-time information; and support to an unlimited number of users and areas.

The advanced system has improved accuracy and timing systems. Each satellite is more autonomous than the first generation GPS and does not require ground station updates as frequently. The system also has improved signal availability and survivability. New signal structures, theater coverage satellite beam, and power transition management will enhance military utility. Improvements in systems that augment GPS accuracy will provide a capability to replace current precision approach aids for military, civil, and international aviation systems. Navigation control segment upgrades improve accuracy and allow users to be aware of degraded NAV signal performance and changes in position accuracy. Aft-facing antennae allow space-based systems at higher altitudes to utilize the GPS signal. Other functions assisted by GPS III include mapping, aerial refueling rendezvous, geodetic surveys, and search and rescue operations. GPS also enhances accuracy of munitions through in-flight navigational correction and facilitates simultaneous use of forces.

Limitation:
- Susceptible to anti-satellite weapons
- Jamming will not affect the transmitting GPS satellites but can affect the receivers.

Performance

Category(ies)	Data
Dimensions	66" high x 81" wide x 98.7" deep; with tip-to-tip wing span of 676". Weight: 4200 lbs
Launch Platform(s)	medium space lifter, SOV, RLV
Orbit	10,900 miles
Other	GPS Spatial Temporal Anti-Jam technology and ultra-tight INS coupling allow

	GPS III signals to be tracked in a 100dB jamming environment. Post correlation nulling techniques are also being used to enhance C/A code acquisition A/J performance (80dB+). Narrow Band interference is easily negated, and a large number of jammers may be nulled simultaneously.
Powerplant	Solar panels generating 4500 watts

System: Ground-Based Space Surveillance - EO

Category: C4ISR
Function(s):
- Counterspace
- Intelligence
- Reconnaissance
- Surveillance

Long Description: The Ground Based Electro-Optical Deep Space Surveillance (GEODSS) is part of the Ground Based Space Surveillance system. The GEODSS brings together telescopes, charge-coupled device cameras (ccd or low-light-level television cameras), and computers to track objects in space. The system works by taking very rapid electronic snapshots of the field of view. The telescopes are moved at the same rate as the stars appear to move, keeping stars in the same positions in the field of view. The snapshots are fed into four computers, which overlay the pictures and erase the stars. The man-made objects, moving at different speeds, remain, and this data is used to figure the positions of objects such as satellites in orbits from 3,000 to 22,000 miles.

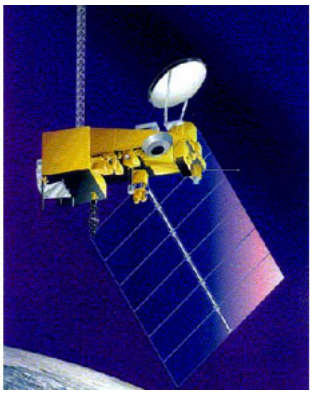
There are three GEODSS sites, located at Socorro, New Mexico; Maui, Hawaii; and Diego Garcia. Each site has three telescopes, two main and one auxiliary, except for Diego, which has three main telescopes. The GEODSS system supplies data on cataloged deep space objects, new domestic launches and foreign launches, uncorrelated targets and other targets as tasked by the AFSCC, Alternate Space Control Center (ASCC), or the CIC.

Limitation:
- Operates only at night
- System vulnerable to attack by both conventional and unconventional means
- Cloud cover and weather limits effectiveness
- Limited to line of sight

Performance

Category(ies)	Data
Coverage	FIELD OF VIEW: Two-degree field of view Collects data on 7200 Deep Space Objects
Dimensions	APERTURE: 40 inch (Main)
Range	Up to 19,117 nm (35,404 km) in space

System: National Polar-Orbiting Operational Environment Satellite System (NPOESS)



Category: C4ISR
Function(s):
Weather Services

Long Description: The National Polar-Orbiting Operational Environment Satellite System (NPOESS), a joint Department of Commerce and Department of Defense initiative, is a constellation of three satellites which collects and disseminates global and regional meteorological and environmental data including imagery; atmospheric temperature and moisture profiles; and terrestrial, climatic, oceanographic, and solar geophysical information. NPOESS also provides a search and rescue support capability.

The NPOESS Space Segment collects and transmits data to the Ground-Based Interface Data Processor Segment (IDPS). The NPOESS Space Segment also provides real-time data to land- and ship-based, fixed and mobile environmental receivers operated by the USAF, USN, USA, USMC, and USCG.

The IDPSs, part of the NPOESS Ground Segment, receive and convert NPOESS raw data records into environmental data records used for modeling and forecasting. AFSPC and NOAA provide C3 support to NPOESS operations. NOAA provides C3 support from the Command and Data Acquisition ground stations at Fairbanks, AK and Wallops Island, VA and a Satellite Operations Center at Suitland, MD. AFSPC provides C3 support from the Satellite Operations Center at Schriever AFB, CO.

Limitation:
- Susceptible to anti-satellite weapons and jamming
- Sensors degraded by clouds and precipitation; datalinks and platform susceptible to space weather-caused outages and anomalous behavior

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Performance

Category(ies)	Data

System: Notional Electro-Optical/Infrared Surveillance System (EISS)

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Category: C4ISR
Function(s):
Intelligence
Reconnaissance

Long Description: The EO/IR Surveillance System (EISS) has 8 satellites orbiting at MEO altitude on 8 geometrical planes. The EISS provides overlapping access to all areas of the globe. A theater of interest will be serviced by at least 1 satellite at all times, with frequent coverage of by 2 or 3 satellites.

Satellite-pointing permits access from horizon to horizon. Within the access area a single satellite is able to monitor the full area of regard in panchromatic, multispectral, and hyperspectral imaging modes without repointing. Within the area of regard, the system is able to image spots simultaneously and collect up to 3,600 km2 per minute in either panchromatic or MSI modes. Hyperspectral imaging operates with reduced collection rates.

The EISS system has an inherent capability to image 24 hours per day by selecting the appropriate IR band in twilight or darkness.

Limitation:
- Cloud cover can limit detection capability
- Vulnerable to some anti-satellite weaponry and dazzling

Performance

Category(ies)	Data
Capability	Image Quality: GSD, NIIRS Comparable to current systems Resolution: Panchromatic = 1 m Multispectral = 4 m Hyperspectral = 8 m This resolution will be downgraded at the longer wavelengths roughly as follows: Day: 1m Evening/Twilight: 2-4 m Night Imaging: 6-10 m Access Area: Horizon to horizon Area of Regard: Approximately 100,000 km2

	Spot Size: 2 km x 2 km
Constellation	Geolocation: Targeting quality
	Altitude: 10,000km
	Collection Orientation: Nadir and off-axis
Launch Platform(s)	Medium spacelift, SOV/SMV
Orbit	Orbit Type: Walker, Circular
	Inclination: 40 degrees

System: Notional Hyperspectral Imaging (HSI) System

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Category: C4ISR
Function(s):
C4ISR

Long Description:	The Notional Hyperspectral (HSI) System is a constellation of satellites providing near-real-time surveillance and reconnaissance to warfighters and other end users. The constellation is located in several orbit regimes to provide continuous access to most regions of the globe. The system provides spectral information in various bands against a wide variety of targets.
Limitation:	- Communications bandwidth and data-processing capabilities - Ground stations susceptible to sabotage and attack - Communications links susceptible to jamming - Spacecraft susceptible to anti-satellite weapons (ASAT)

Performance

Category(ies)	Data

System: Notional Signal Intelligence (SIGINT) System

PHOTOGRAPH NOT AVAILABLE

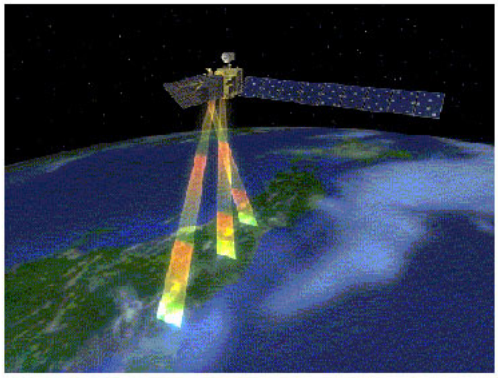
Category: C4ISR
Function(s):
C4ISR

Long Description:	The Notional Signals Intelligence (SIGINT) System is a constellation of satellites providing near-real-time surveillance and reconnaissance to warfighters and other end users. The constellation is located in several orbit regimes to provide continuous access to most regions of the globe. The system provides SIGINT in various bands against a wide variety of targets.
Limitation:	- Communications bandwidth and data processing capabilities - Ground stations susceptible to sabotage and attack - Communications links susceptible to jamming - Spacecraft susceptible to anti-satellite weapons (ASAT)

Performance

Category(ies)	Data

System: Notional Synthetic Aperture Radar (SAR) System



Category: C4ISR
Function(s):
- Intelligence
- Reconnaissance
- Surveillance

Long Description: The Notional Synthetic Aperture Radar (SAR) System is a constellation of satellites designed to provide Near-Real-Time (NRT) surveillance and reconnaissance. The constellation in Low Earth Orbit (LEO) has worldwide access to all regions between 65 degrees north to 65 degrees south latitudes. The system provides targeting quality SAR imagery. Digitized Terrain Elevation Data (DTED) can also be provided.

Limitation:
- Number of on-orbit operational spacecraft; 50% duty cycle; number of simultaneous operations
- Communications band width and data processing capabilities of user terminals
- Ground stations susceptible to sabotage and attack
- Communications links susceptible to jamming
- Radar sensor susceptible to jamming, spoofing; adversary can use denial and deception techniques
- Spacecraft susceptible to anti-satellite weapons (ASAT)

Performance

Category(ies)	Data
Capability	SPOT MODE: Within a 150,000 km2 AOI, the system can deliver up to 78 4x4 km point targets per hour with 0.3 meter resolution. STRIP MODE: Delivers the full AOI within one hour with 3.0 meter resolution These modes are not simultaneous but can be time sequential and allocated in any manner, i.e., 26 point targets, 10,000 km2 of scan, and 50,000 km2 of strip per hour. Post delivery processing requires 10 minutes to produce useable targeting products from the delivered raw data. DTED Level 4 can be provided for 50,000 km2 within one day.
Other	TASKING: Tasking for a pass over an AOI is collected, prioritized, and nominally uplinked prior to horizon break of the tasked spacecraft over the AOI to maximize collection time. Spacecraft can be dynamically tasked

during the pass from a ground station with appropriate capabilities, with the penalty of time required to reconfigure and validate the spacecraft's schedule.

System: Polar Final (EHF)

Category: C4ISR
Function(s):
Command and Control

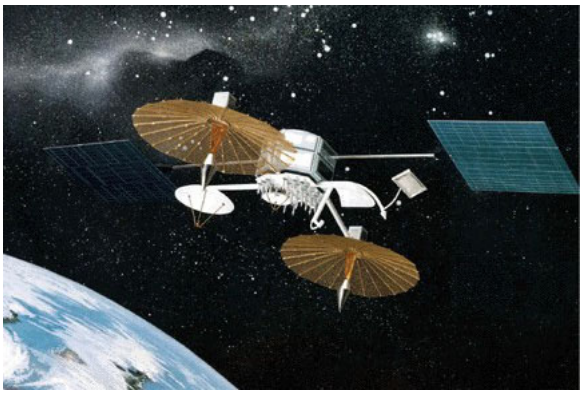
Long Description: Polar Final is a constellation of three satellites that provide continuous communications coverage over the North Pole region. Each satellite is located in a highly elliptical Molniya orbit and contains a modified Extremely High Frequency (EHF) payload. Polar Final is hardened against nuclear blasts and RF jamming.

Limitation:
- Throughput is not sufficient for high bandwidth requirements
- Molnyia orbits potentially vulnerable to ASAT attack at perigee
- Ground gateways are high value targets
- Cannot be serviced by shuttle or SMV

Performance

Category(ies)	Data
Capability	Operational Throughput: 75 bps to 2.4 Kbps Max Throughput: 9.6 Kbps Coverage: 65-degrees North to 90-degrees North
Dimensions	8' x 8' x 8' Weight: ~2000lbs (dry)
Launch Platform(s)	Medium EELV
Orbit	HEO; Molnyia

System: Space-Based Data Relay (SBDR)



Category: C4ISR
Function(s):
Counterair

Long Description: Space Based Data Relay (SBDR) provides near continuous telemetry, tracking and communications services. Operating through a dedicated ground station, each satellite permits two-way communications between orbital systems and the ground. Located 22,300 miles above earth, one or more SBDR satellites are always within range of the ground station and any orbital system.

SBDR is the follow-on to NASA's Tracking and Data Relay Satellite System (TDRSS), and will include improved reliability of the communication payload's forward and return links. The satellite's S- and Ku-band single access transmitters use solid-state power amplifiers. On the S- and Ku-band single access receive side, low noise amplifiers using gallium arsenide-based field effect transistors have replaced old technology parametric amplifiers. These low noise amplifiers consume less power and operate more reliably than their predecessors. The same low noise amplifiers have been incorporated elsewhere in the communications payload to improve the reliability and performance of SBDR's S-band multiple access return service.

The SBDR space segment may consist of up to six on-orbit satellites located in geosynchronous orbit (GEO). Three SBDR satellites are available for operational support at any given time. The operational spacecraft are located at 41, 174 and 275 degrees west longitude. The other satellites in the constellation provide ready backup in the event of a failure to an operational spacecraft and, in some specialized cases, resources for target of opportunity activities.

The SBDR ground segment consists of two functionally identical ground terminals. Data is uplinked from the ground segment to a targeted orbital system via a SBDR satellite. Return data is downlinked via the SBDR satellite to the ground segment and then on to a designated data collection location.

Limitation:
- Susceptible to anti-satellite weapons
- Limited polar coverage
- Small number of control targets provide lucrative targets
- Information Warfare

Performance

Category(ies)	Data
Orbit	Geosynchronous
Other	57.2 ft (17.4 m) by 42.6 ft (12.9 m), 4,668 lb (2,120 kg)
Powerplant	1850W

System: Space-Based Infrared System (SBIRS)

Category: C4ISR
Function(s):
C4ISR

Long Description: The SBIRS architecture is a constellation of two different types of satellites: 4 Geosynchronous (GEO) (SBIRS High) and 28 Low Earth Orbiting (LEO) (SBIRS Low) satellites that provide warning of both cruise and ballistic missile attacks, technical intelligence (MASINT), and battlespace characterization. The SBIRS architecture also includes ground assets such as a CONUS-based Mission Control Station (MCS), a back-up MCS (MCSB), a survivable MCS, overseas Relay Ground Stations (RGSs), Multi-Mission Mobile Processors, and associated communications links.

SBIRS contributes to both national and theater missile defense by providing reliable, accurate, and timely, over-the-horizon mid-course tracking data to defensive systems. The track data cues interceptors to launch earlier than autonomous radar alone. This cueing effectively extends an interceptor's range and increases its effectiveness. SBIRS provides information to policy makers and other users on observed military tactics, new foreign technology developments, arms control compliance, and proliferation activities.

SBIRS HIGH: Each GEO satellite has two identical IR sensor systems. A pointing mirror is used to direct IR energy through the telescope to the focal plane array. The use of a pointing mirror makes the sensor very agile and allows for rapid repositioning of the earth disk on the focal plane-- equivalent to reorienting the entire telescope assembly. The sensors are independent of each other and can operate as scanners, starers, or a combination of both, providing a highly taskable sensor system. One concept of operations uses one sensor as a whole-earth scanner to provide strategic coverage while using the other to stare at or repeatedly scan small areas of interest. The agility of the pointing mirror means that higher revisit rates in scanning mode are possible, resulting in more hits on a given target and more accurate tracking information. In staring mode, the agile sensor can cover a large number of widely spaced areas of interest. SBIRS HIGH provides complete coverage of the northern hemisphere and most of the southern hemisphere, providing warning of hostile ground-launched cruise and ballistic missile launches, ballistic missile tracking through burnout, launch point and initial impact point prediction, and target handover to ground-based radar, AWACS, and SBIRS Low Earth Orbit Space and Missile Tracking System (SMTS). SBIRS High can also provide cruise missile launch warning and hand-off to ground-based radar, AWACS, and other ground or air-based platforms. SBIRS High see-to-ground sensors gather technical intelligence and perform battlespace characterization and pass this information on to the warfighter in

real-time. SBIRS High provides reliable, accurate and timely threat performance and infared target signature data to warfighters and weapons developers. It also provides target classification and identification profiles and algorithms for SBIRS operational missions.

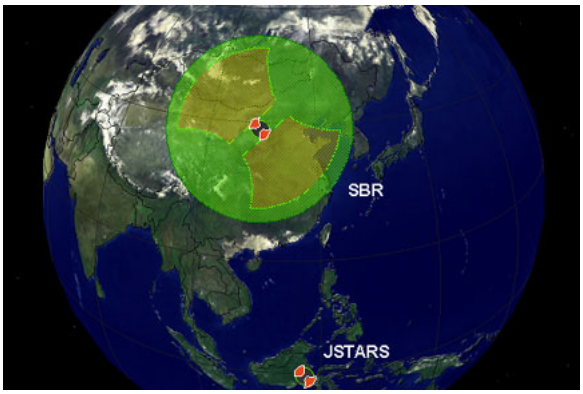
SBIRS LOW: SBIRS LEO satellites have an acquisition sensor and a tracking sensor. The acquisition sensor has a wide field of view and is used to detect ballistic missiles in boost phase and track them to burnout. At burnout, the acquisition sensor hands off the target to the tracking sensor, which follows the target through the midcourse portion of its flight until reentry. This midcourse tracking enables SBIRS Low to contribute most to the missile defense mission by providing extremely accurate position information on incoming warheads to defensive systems SBIRS Low is capable of tracking small, cold bodies such as nuclear-armed reentry vehicles against the deep space background. As an integral part of the SBIRS architecture, SBIRS Low accepts and also generates cues and tip-offs of events of interest to the intelligence community. SBIRS Low will also conduct space surveillance and space object identification.

Limitation: - Susceptible to jamming and advanced anti-satellite weapons

Performance

Category(ies)	Data
Launch Platform(s)	SOV, medium spacelift

System: Space-Based Radar



Category: C4ISR
Function(s):
C4ISR

Long Description: The Space Based Radar (SBR) System is a constellation of satellites designed to provide integrated near real-time (NRT) surveillance and reconnaissance to warfighters and other end-users located in theaters worldwide. The constellation has global access to most regions on the Earth. The system provides both targeting quality Synthetic Aperture Radar (SAR) imagery, terrestrial (ground and marine) Moving Target Indicator (MTI) including High Range Resolution (HRR). Digitized Terrain Elevation Data (DTED) can also be provided. The constellation provides continuous theater access, and NRT data transfer (communications delays only) to ensure rapid servicing of worldwide mobile and fixed surface targets to a variety of warfighters and other end users. It is robust enough to support multiple Major Theater War (MTWs) full time and provide significant capabilities simultaneously to other customers in the federal and civil sectors.

The health and status of the on-orbit satellites is maintained by CONUS-based spacecraft operations centers. The centers manage the constellation as a whole and ensure individual spacecraft are properly scheduled, charged, and configured to support tasked operations. Some spacecraft can be put back and remain on-line with degraded performance if anomalies cannot be completely resolved.

The CJTF will have tasking authority over this system in accordance with the rules of engagement. Tasking for a pass over an AOI is collected, prioritized, and nominally uplinked prior to horizon break of the tasked spacecraft over the AOI to maximize collection time. Spacecraft can be dynamically tasked during the pass from a ground station with appropriate capabilities, with the penalty of time required to reconfigure and validate the spacecraft's schedule.

Collected data can be downlinked, relayed, or broadcast in NRT over the AOI. Processed and unprocessed data can be received and fully processed by any ground station terminal with the proper communications and processing capability. Full processing capability for all products requires a ground station of sufficient capability that it could be transportable (i.e. roll-on, roll-off vans), but not considered mobile (i.e. HMMWV or RTIC). Limited processing of some products like MTI can be sufficiently packaged for larger mobile receivers. Normal products would be processed by a few in-theater centers with secondary dissemination to a wide variety of mobile end users.

Limitation:
- Communications band width and data processing capabilities of user terminals
- Ground stations susceptible to sabotage and attack
- Communications links susceptible to jamming
- Adversary may use denial and deception techniques
- Spacecraft susceptible to anti-satellite weapons (ASAT)

Performance

Category(ies)	Data
Capability	Duty Rate: 25%, each satellite can provide a minimum of three simultaneous JSTARS Ground Reference Coverage Areas (GRCAs) equivalents over an AOI For MTI, the SBR system can provide continuous wide area surface surveillance within a selected theater. On the surface, moving targets down to 5 m2 in size between 3 and 150 kph can be detected with an area rate of 1500 km2 per sec and geolocated within 10 m. MTI data is immediately processed and useable upon delivery. MTI and SAR capabilities can switch back and forth in less than five seconds. The HRR mode for rough moving target identification can only be performed simultaneously with the MTI. HRR data requires five minutes of post processing after delivery for a usable product. Each satellite can be programmed to trigger SAR from the MTI mode when a target of possible interest is detected. For SAR imagery, the SBR operates in two different modes, scan and spot. In the scan mode, it can deliver a complete scan with 1.0 meter resolution of a 150,000 km2 Area of Interest (AOI) every hour. In the spot mode, the system can deliver up to 2,800 4x4 km point targets per hour worldwide with 0.3 meter resolution. In a 150,000 km AOI 120 point targets can be serviced in one hour. The scan/spot modes are not simultaneous, but can be time sequential and allocated in any manner. Also, the constellation is seemingly ubiquitous since, at any time, one spacecraft can be overhead scanning while another is overhead taking point targets.
Orbit	Coverage: Roughly a circular pattern with a 1300 nm radius for GMTI and a "battle-axed" shape of approximately 1000 nm radius for SAR. Increased availability over high threat theaters and zero coverage over poles (greater than +/- 70 deg latitude).

System: Space-Based Space Surveillance

Category: C4ISR
Function(s):
- Counterspace
- Intelligence
- Reconnaissance
- Surveillance

Long Description: The Space-Based Space Surveillance (SBSS) system consists of three optical sensing satellites in 800 km LEO orbits that provide up-to-date data for identification and status determination of objects of interest in earth orbit. These satellites can be deployed using EELV's, SOVs or other spacelift assets, and can be employed with SBL, microsats, SOV, and ground-based ASAT weapons to perform ASAT and space superiority missions. The system routinely monitors, identifies and tracks space objects to support Space Order of Battle (SOB) and Space Object Identification (SOI). SBSS improves the responsiveness of the acquisition and reporting of tracking data on new foreign launches (Initial orbit determination) and on objects with orbital changes due primarily to maneuvers. SBSS has sufficient tracking capacity to support maintaining 100% of the Deep Space catalog, with considerable capacity for detecting maneuvered, new and lost objects. The system would also be able to detect and track a significant portion of near-earth SOB and other routine satellites.

The satellite is powered by a very high lSP propulsion system, which allows for both long life and the ability to observe many satellites in orbits varying from Low Earth Orbit (LEO) to semi-synchronous orbit. Its sophisticated sensor suite is capable of detecting and locating even stealthy satellites. Once located, the Space-Based Space Surveillance satellite provides information on the type of satellite under surveillance and its probable capabilities, including weapons of mass effect and/or ASAT weapons.

Limitation:
- Susceptible to anti-satellite weapons
- Small number of control centers provide lucrative targets
- Ability to jam the down link via data relay, microsats, or SOF
- Electronic military deception and information attack against the satellite
- Requires a capable launch infrastructure
- Unable to look at some objects with angles approaching the sun
- Slight breaks in surveillance at some angles
- Data can be delayed during downlink to ground station during even routine missions

Performance

Category(ies)	Data
Capability	Coverage - All GEO longitudes
Orbit	LEO

System: Wideband Gapfiller System (WGS)

Category: C4ISR
Function(s):
- C4ISR
- Command and Control

Long Description: Wideband Gapfiller Satellite (WGS) is a high-capacity satellite communications system that provides additional capabilities to legacy systems, yet is compatible with existing control systems and terminals. WGS will provide two-way X-band and Ka-band communications as well as Ka-band broadcast services to the US Armed Forces and other agencies worldwide. WGS will augment DoD communications services currently provided by the Defense Satellite Communications System (DSCS), which provides Super High Frequency (SHF) wideband communications and by the Ka-band Global Broadcast Service (GBS), which uses direct broadcast satellite technology to provide critical information to US and allied forces. Launched aboard the EELV, the WGS will serve as a bridge to the Advanced Wideband Satellite System, a high capacity tactical communications system currently planned for 2009 and beyond. WGS combines commercial spacecraft capabilities including phased array antennae and digital signal processing technology. WGS offers 4,875 GHz of instantaneous switchable bandwidth. The system will provide capacity ranging from 2.4 to 5.4 Gbps to tactical users, depending on the mix of ground terminals and modulation schemes employed. The design includes 19 independent coverage areas that can be used throughout the field of view of each satellite to serve warfighters between 65 degrees North and South latitude. The connectivity capabilities of WGS enable any user to talk to any other user and very efficient use of satellite bandwidth.

Limitation:

Performance

Category(ies)	Data
Other	Mass: 3000 kg Power: 11 kW Life Span: 14 year

System: E-10A Multi-Sensor Command and Control Aircraft (MC2A)

Category: C4ISR
Function(s):
- Command and Control
- Intelligence
- Reconnaissance
- Surveillance

Long Description: The Multi-Sensor Command and Control Aircraft (MC2A) is a wide body platform with the next generation of modularized, flexible and multifunctional radars. It subsumes missions currently executed by E-3 (C2/BM and Air Surveillance), EC-130E (C2),and the E-8 (C2/BM and GMTI Surveillance) aircraft.

The MC2A is the key piece of the C2ISR constellation that will extend the commander's eyes and ears while serving as a primary element of the theater C2 architecture. A constellation of high and medium altitude endurance UAVs will augment and supplement the sensor capabilities of the MC2A to provide precise target location/identification data. There will be a seamless shift from tasking sensors for collection to tasking to support targeting. The MC2A will also interface with space-based sensors, fighter and bomber aircraft and other sensors creating decision-quality data to increase battlespace awareness and shorten the decision cycle for combat operations, such as the detection, designation, and prosecution of Time-Critical-Targets (TCT).

The wide range of potential Air Expeditionary Force (AEF) employment scenarios require the MC2A have the maximum flexibility to support everything from autonomous operations to robust deployed force packages. The UAVs endurance and versatility and the SBRs responsive deep-access capabilities ensure a highly capable C2ISR force. The challenges facing the Air Force will involve the ability to rapidly respond to these contingencies with a horizontally integrated C2ISR constellation that develops situation awareness (SA) quickly and immediately provides lethal joint battlespace capabilities. Thus, the MC2A should be capable of entering the area of responsibility (AOR) on day one of a contingency, provide the Combat Operations function and SA autonomously or in support of a deployed theater AOC/CAOC, while simultaneously providing worldwide C2 reach-back to critical command centers.

Limitation: - Susceptible to jamming, information warfare attacks, surface-to-air missiles, air-to-air missiles, and anti-aircraft artillary

Performance

Category(ies)	Data
Crew	pilot and copilot; 45 mission members
Endurance	8 Hours on-station time
Other	UAVs will complement the MC2A aircraft by contributing capabilities not residing on the aircraft. It will also be invaluable in extending the overall coverage of the constellation either through increased detection with sensors or through relay capability. Depending on tasking and contingency requirements, these UAV platforms may operate autonomously, supporting the AOC/GTACS or in conjunction with the MC2A. High altitude endurance UAVs may be launched from bases thousands of miles away from the theater of operations.
Powerplant	Pratt and Whitney PW4062 General Electric CF6-80C2B8F
Range	5,600 NM
Sensor	The MC2A performs immediate, long range, theater-wide deep-look surveillance and reconnaissance and conducts selective exploitation of data for CID. Sensors are capable of detecting and tracking distant low radar cross-section air targets and distinguishing between small surface combatant and noncombatant vehicles. They incorporate advanced systems supporting situation awareness, electronic order of battle (EOB) update, threat warning, information warfare, and rapid detection and identifying of TCTs. In addition, they have extensive communication and CID capabilities to provide immediate friendly/hostile indication for beyond visual range (BVR) targeting and preventing fratricide. Additionally, sensors provide high resolution MTI/SAR imagery, foliage penetration (FOPEN - "tanks under trees"), low probability of intercept (LPI) signal collection, electronic warfare, and other information disruption capabilities, and advanced CID.
Support Requirements	The Distributed Common Ground System (DCGS) will support the MC2A, UAV, space-based and ground-based sensor collection architecture with timely, accurate, and tailored processing, exploitation, and dissemination of ISR data throughout the entire spectrum of conflict. This support includes target cueing, identification, activity detection, cooperative precision geo-location of threat platforms and emitters, and target confirmation. While selected and limited exploitation will be done onboard the MC2A to support CID, complex data issues that may not be efficiently processed or integrated onboard the aircraft are resolved within the DCGS.

System: E-3 Airborne Warning And Control System (AWACS)

Category: C4ISR
Function(s):
- Command and Control
- Counterair
- Counterland
- Countersea
- Intelligence
- Reconnaissance
- Surveillance

Long Description: Airborne Warning and Control System (AWACS) aircraft provide all-weather surveillance, command, control, and communications. AWACS is also an air defense system used to detect, identify, and track airborne objects or airborne enemy forces. AWACS can actively discriminate friend from foe and can vector friendly aircraft in on hostile aircraft. The E-3 Sentry is a modified Boeing 707/320 commercial airframe with a rotating radar dome. It contains a radar subsystem that permits surveillance from the Earth's surface up into the stratosphere, over land or water. Combined with an identification friend or foe subsystem, the radar can look down to detect, identify, and track enemy and friendly low-flying aircraft by eliminating ground clutter returns that confuse other radar systems. The radar has a range of more than 200 miles (320 kilometers) for low-flying targets and further for aerospace vehicles flying at medium to high altitudes. Other major subsystems in the E-3 are naviagtion, communications, and computers. The radar and computer subsystems on the E-3 can gather and present broad and detailed battlefield information. An advanced open system architecture for AWACS computers has evolved to allow the rapid insertion of new sensors, displays, and tactical analysis capabilities. These improvements have enabled AWACS to efficiently accommodate and react to the flood of digital information now coming to warfighters and could expand AWACS' current role, transitioning it to a theater information resource center and, potentially, a flying battle command center. The Advanced Open System Architecture (AOSA) possesses "true" plug-and-play capability, recognizing, accepting, and integrating Commercial Off-The-Shelf (COTS) hardware, software, and server platforms from a variety of vendors. Battle management, command, control, communications and intelligence capability is provided to ground-based applications such as air traffic management and surface-based battlefield area data dissemination. It can direct fighter-interceptor aircraft to these targets. It is a jam-resistant system that has performed missions while experiencing heavy electronic countermeasures. The flight path can quickly be changed according to mission and survival requirements, and the E-3 can fly a mission profile for more than eight hours without refueling. Its range and time on-station can be increased

through inflight refueling. Combined ISR and C3 capabilities make AWACS a critical element in joint and coalition offensive counter-air (OCA) and defensive counter-air (DCA) efforts. In support of air-to-ground operations, the E-3 provides direct information needed for interdiction, reconnaissance, airlift and close-air support for friendly ground forces. In addition, the E-3 provides information to commanders about air operations to gain and maintain control of the air battle; it is a key element in attaining and sustaining information superiority.

Limitation: - Susceptible to air-to-air missiles, anti-aircraft artillery, jamming, and RF/EMP weapons.

Performance

Category(ies)	Data
Ceiling	Above 29,000 ft. (8,788 m)
Crew	Flight crew of four, plus mission crew of 13-19 specialists
Other	SPEED: Optimum cruise 312 knots (Mach 0.48) MAX TAKEOFF WT: 347,000 lbs. (156,150 kg)
Powerplant	4 Pratt and Whitney TF33-PW-100A turbofan engines
Range	Unlimited with aerial refueling ENDURANCE: Over 8 hours without refueling; Up to 24 hours with refueling

System: E-4B Nat'l Airborne Ops Center - Follow-on

Category: C4ISR
Function(s):
Command and Control

Long Description: The E-4B follow-on serves as the National Airborne Operations Center for the President, Vice President and Secretary of Defense. In the event of a national emergency or destruction of ground command and control centers, the aircraft provides a modern, highly survivable, command, control and communications center to direct U.S. forces, execute emergency war orders, and coordinate actions by civil authorities. The E4-B is air refuelable.

Limitation:
- Susceptible to surface-to-air missiles, air-to-air missiles, anti-aircraft artillery, and jamming
- Non-stealthy; large radar cross-section

Performance

Category(ies)	Data
Ceiling	Over 30,000 ft (9,144 m)
Crew	Up to 114
Max T/O Weight	875,000 lbs (397,000 kg)
Powerplant	Four Pratt & Whitney PW4062 or four Rolls Royce RB2111-524H or four GE CF6-80C215
Range	8,300 nm (13,360 km) unrefueled ENDURANCE: 12 hours unrefueled
Speed	547 knots (Mach 0.85)

System: E-8 Joint Surveillance and Target Attack Radar System

Category: C4ISR
Function(s):
- Intelligence
- Missile Defense
- Reconnaissance
- Surveillance

Long Description: The E-8 Joint Surveillance and Target Acquisition and Attack Radar System (JSTARS) is a modified Boeing 707 developed to undertake ground surveillance, targeting, and battle management missions. JSTARS aircraft can look deep into hostile and potentially hostile areas to detect, locate, classify, and track trucks, tanks, and a variety of other targets at ranges in excess of 155 miles. Its role has been expanded to include bomb-damage assessment, suppression of enemy air defenses, and theater missile defense with an emphasis on detecting mobile missile launchers and their decoys. JSTARS gives warfighters the ability to see the disposition of enemies' ground formations, understand their intentions, and support the destruction of their forces before they reach the main battle area. JSTARS are also capable of conducting attack planning and support functions to assist in the planning and execution of attacks by forces on the ground or in the air.

The E-8 is equipped with, and named after, a multi-mode Joint Surveillance Target Acquisition and Attack Radar System (JSTARS). JSTARS are capable of all-weather, day/night operations. The radar is integrated with GPS and operates in a synthetic aperture radar (SAR) mode. When used, it alternates between SAR and Doppler. Wide area surveillance (WAS), moving target indicators (MTI), with a rapid revisit rate, gives a broad picture of enemy movements within a corps-size area of interest. It can detect and track moving and fixed targets through this entire corps-sized area of influence for attack by tactical aircraft, maneuver forces, attack helicopters, and artillery. In real time, JSTARS employs jam-resistant, high-capacity, digital data links and radio. Its communications system includes UHF, VHF, SATCOM, and secure data links to operations centers.

Each aircraft contains 18 operations consoles, two of which double as communications stations. JSTARS can communicate directly with Army and Air Force operations centers. Army ground station modules send radar service requests to the JSTARS and receive pre-processed data via secure links. These 18 stations also display color-coded images of radar data and information from AWACS aircraft of behind-the-lines terrain and of moving wheeled and tracked vehicles. An estimated 386,100 sq miles can be covered

during a single 8 hours sortie at 30,000-40,000 ft. The system features moving-target indicator and fixed-target indicator modes, on-board battlefield surveillance, attack planning, targeting, and control, and post-attack assessment.

Limitation:

- Susceptibility to surface-to-air missiles, air-to-air missiles, anti-aircraft artillery, and jamming limits effective range
- Large radar cross-section
- Radar coverage limited by horizon, altitude and terrain/foliage/obstruction masking

Performance

Category(ies)	Data
Ceiling	42,000 ft (12,801 m)
Crew	21 (3 flight crew); 34 (6 flight crew) for long endurance missions
Dimensions	LENGTH: 152 ft, 11 in HEIGHT: 42 ft, 6 in WINGSPAN: 145 ft, 9 in WEIGHT: Empty 171,000 lbs (77,564 kg); Gross 336,000 lbs (152,407 kg)
Powerplant	4 Pratt & Whitney JT3D-3B turbojets; each 18,000 lbs of thrust
Range	SPEED: 547 knots (0.84 Mach) RANGE: 11 hrs, 20 hours with one in-flight refueling

System: RC-135 Rivet Joint

Category: C4ISR
Function(s):
C4ISR
Command and Control

Long Description: The RC-135 reconnaissance aircraft, Rivet Joint, provides real-time battle management information to mission planners, commanders and warfighters. The aircraft is a long range, high-altitude version of the C-135, which is a militarized version of the Boeing 707. The Rivet Joint works closely with the E-3 AWACS providing direct, near real-time reconnaissance information and electronic warfare support to theater commanders and combat forces.

Although the flight crew stations are similar, internal reconnaissance equipment varies in the type of sensors, receiver systems, probe, blade, wire and dielectric panel antennae, camera windows and fairings installed. All RC-135s are equipped with an air refueling system giving the aircraft extended range. Rivet Joint carries high, very high, and ultra high frequency radios, radar, and Doppler/GPS/stellar/INS navigation systems.

There are several other variants to the RC-135 design series, each with their own specific misssion.

RC-135S COBRA BALL
The RC-135 Cobra Ball collects intelligence on strategic and operational/tactical ballistic missiles. It has TELINT and OPINT capabilities, and is used for Theater Missile Defense (TMD). Connectivity includes JTIDS and TIBS data links, allowing real time transmission of data. The Cobra Ball sensor package, Theater Airborne Warning System (TAWS) fuses data between different IR sensors, provides early warning of missile launch, improves launch/impact point predictions, and aids in fixing theater missile defense shortfalls. The Cobra Ball capabilities can provide timelines and accuracy information against a scud-type target at operational ranges and aspect angles.

RC-135U COMBAT SENT
The RC-135 Combat Sent aircraft is a scientific and technical ELINT collection system that detects enemy signals including radio frequency. The information is provided to system designers for development of countermeasures.

TC-135 AARE
The TC-135 is a trainer variant of the RC-135 that also conducts an air sampling mission

with Advanced Atmospheric Research Equipment (AARE). AARE is a roll-on/roll-off RO/RO platform that provides the follow-on air sampling capability to replace the WC-135. The AARE aircraft will be equipped with the PGT Radio and will conduct gas and particulate sampling at an altitude of 32,000 ft.

Limitation: - Susceptible to jamming, information warfare attacks, surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery

Performance

Category(ies)	Data
Ceiling	35,000 feet with typical mission at 24,000 feet
Crew	flight crew of 4; 25-35 mission crew
Dimensions	Length: Cobra Ball, 140 feet - Cobra Sent, 136 feet Span: Cobra Ball, 131 feet - Cobra Sent 135 feet Height: 38 feet
Max T/O Weight	299,000 lbs
Powerplant	4 CFM International F108-CF-100 turbofans; each 22,224 lbs of thrust or 4 Pratt & Whitney JT3D-3Bs from Boeing 707-100Bs
Range	5000 NM
Speed	> 435 knots

System: TC-135 Advanced Atmospheric Research Equipment (AARE)

PHOTOGRAPH NOT AVAILABLE

Category: C4ISR Platforms - Manned Airborne Platforms
Function(s):
Surveillance

Long Description: The Advanced Atmospheric Research Equipment (AARE) provides the US Air Force with the ability to monitor foreign nuclear tests. AARE provides a unique capability to do treaty monitoring and sampling against worldwide nuclear testing activities. AARE replaces the Atmospheric Research Equipment (ARE) equipment, which was the only Air Force airborne Nuclear Debris Collection and Analysis asset in service. AARE is composed of modularized systems that can be deployed on any of three designated Air Combat Command TC-135 training aircraft.

Limitation:

Performance

Category(ies)	Data

System: UAV Global Hawk (RQ-4)

Category: C4ISR
Function(s):
C4ISR
Information Operations

Long Description: Global Hawk is a high-altitude, long-endurance unmanned aerial reconaissance system capable of carrying ISR, SIGINT/ELINT, and communications relay payloads. Its advanced technology sensors, long range, and the ability to remain on station for long periods of time enable the Global Hawk to provide the warfighter with the essential intelligence needed to achieve information dominance throughout the battle space. The aircraft's 13,500 nm range and 36 hour endurance, combined with satellite and line-of-site communication links to the ground segment, permit worldwide operation of the system. High resolution sensors can look through adverse weather day or night from an altitude of 65,000 ft.

The Global Hawk UAV sensor suite includes a synthetic aperture radar (SAR), electro-optical (EO) and infrared (IR) sensors, and SIGINT and ELINT payloads. The SAR can operate simultaneously with either the EO or the IR sensor to enable coverage of wide geographic areas. This capability provides commanders with situational awareness, targeting, and bomb damage assessment.

The communications relay payload can be carried in conjunction with other sensors, allowing the Global Hawk to provide communications capability to other assets.

SAR imagery, which is processed on board the Global Hawk UAV, and EO/IR imagery are transmitted via data link in near real time, over satellite or line-of-light communication paths, to the ground segment. The ground segment receives, buffers, and automatically assembles the final EO/IR image products as imagery standard NITF files. Dissemination of image products is done automatically, in near real time, to users specified in the original tasking requests, over existing infrastructure communications links. The ground segment also supports dynamic retasking of the sensor to respond rapidly to changing conditions in the battlefield environment.

Limitation:
- Susceptible to advanced surface-to-air missiles, air-to-air missiles, and jamming of satellite and line-of-sight communications links
- Not low observable
- Relatively slow moving

- No weapons

Performance

Category(ies)	Data
Armament/Payload	Synthetic Aperture Radar: 1.0/0.3 M Resolution (WAS/Spot). Moving Target Indicator Mode: 4 kts minimum detectable velocity. Electro-Optical: NIIRS 5.5/6.5 (WAS/Spot). Infrared: NIIRS 5.0/6.0 (WAS/Spot). Location Accuracy: <20m CEP. Wide Area Search: 40,000 Sq nm/day. Target Coverage: 1,900 Spot Targets/day. COMMUNICATION: PCS-like circuit oriented voice and data, militarized tactical paging, IPv6 data networking, tactical battlefield multicast, high speed and high throughput infrastructure access, including TCDL LOS and Ku SATCOM, surrogate satellite support for UHF TACSAT and GBS receive/relay, dissimilar radio interoperability, range extension for over-the-horizon connectivity of dispersed and rapidly moving forces.
Dimensions	Length: 44 feet Span: 116 feet Height: 15 feet
Endurance	35 hours
Max T/O Weight	25,600 lbs Max Fuel Load: 14,500 lbs Payload with max fuel load: 2000 lbs
Operational Altitude	60,000 - 65,0000 feet
Powerplant	One turbojet engine
Speed	340 kts
Support Crew	One pilot and two sensor operators in ground control station

System: UAV Predator A (MQ-1)

Category: C4ISR
Function(s):
- C4ISR
- Counterair
- Counterland

Long Description: The Predator A (MQ-1) is a Medium Altitude Endurance (MAE) unmanned aerial vehicle (UAV) which provides tactical, near-real-time imagery intelligence (IMINT) to satisfy reconnaissance, surveillance, and target acquisition (RSTA) mission requirements of tactical commanders. The Predator is part of a system of ISR assets that provides information superiority in support of a major regional conflict and supports strike aircraft by acquiring and tracking targets. The strike capabilities provided by Hellfire antitank missiles give combatant commanders the ability to engage time sensitive targets as they are acquired and tracked with the Predator's sensor package. The Predator also supports such operations as coastal and border surveillance, weapons tracking, embargo enforcement, humanitarian and disaster assistance, support of peacekeeping and counter-narcotic operations. The MQ-1 also has a capability to employ Stinger air-to-air missiles for self-protection.

MQ-1 carries electro-optical/infrared (EO/IR), hyper spectral imagery (HSI), and synthetic aperture radar (SAR) within a 450 lbs sensor package. Utilizing Ku- and UHF-band satellite communication links, the tactical UAV can acquire and pass real-time imagery to ground stations in adverse weather, day or night, and beyond-line-of-sight (BLOS). In addition, the MQ-1 contains a laser designator for targeting. It is capable of mid-flight reprogramming and automatic take-off and landing. In the event of a data link loss, the Predator UAV is programmed to automatically return to its base of operations. Differential GPS is needed at the airfield for take-off and landing.

The Predator can carry a 57 lb mini-UAV module on a pylon under its wing known as Flight Inserted Detector Expendable for Reconnaissance (FINDER). FINDER is released at an altitude of 10,000 ft. and conducts a 25-minute pre-programmed mission before control is passed to a Ground Control Station (GCS) with a technician to land it. Predator can carry two FINDERS. There are various possible payloads for incorporation on FINDER. One mission is atmospheric testing by Predator Infrared Narrowband Hyper spectral Combat Assessor (PIRANHA) prior to combat strikes for use in real-time decision-making. Another mission for FINDER is CBRNE detection.

The Predator A system consists of one GCS and four air vehicles. Four air vehicles can

be employed concurrently and operated from the single GCS. MQ-1 UAV systems are deployed from CONUS through multiple airlift sorties and require extensive disassembly and in-theater reassembly before operational employment.

Limitation:

- Susceptible to surface-to-air missiles, air-to-air missiles, anti-aircraft artillery, and jamming of satellite and line-of-sight comm links
- Not low-observable
- Multiple sorties of C-130s, C-17s, and C-5s needed for air vehicle and ground station deployment
- Relatively slow moving
- Poor adverse weather capability
- Differential GPS needed at airfield for take-off and landing

Performance

Category(ies)	Data
Armament/Payload/Sensor	SENSORS: EO, IR, and SAR, and Hyperspectral (HSI) or SIGINT. Synthetic Aperture Radar: 4-in. resolution. Improved optics can view personnel at 50 nm. SAR, EO/IR, ESM, radio relay. WEAPONS: 2 x Hellfire anti-tank missiles or 2 x Stinger air-to-air missiles
Dimensions	Length: 27 feet Span: 49 feet Height: 7 feet
Endurance	24+ hours
Max T/O Weight	2250 lbs Max Fuel Load: 660 lbs Payload w/ max fuel: 450 lbs
Operational Altitude	15,000 - 25,000 feet
Speed	Cruise: 70 kts Max: 112 kts
Support Requirements	Support Requirements: Crew of 82 provides support personnel, pilots, and sensor operators for one system (one GCS + 4 air vehicles); C-130 compatible

System: UAV Predator B (MQ-9)

Category: Strike
Function(s):
- C4ISR
- Counterland
- Countersea

Long Description: The MQ-9 Predator B is an unmanned aerial vehicle (UAV) that provides tactical, near-real-time imagery intelligence (IMINT) to satisfy reconnaissance, surveillance, and target acquisition mission requirements of tactical commanders. With the capability to carry up to ten Hellfire air-to-ground missiles or other precision guided munitions, the MQ-9 is primarily employed in a hunter/killer role against dynamic execution targets. In its secondary role as an ISR asset, the MQ-9 is part of a system of ISR assets that support strike aircraft by acquiring and tracking targets. It also supports operations such as coastal and border surveillance, weapons tracking, embargo enforcement, humanitarian/disaster assistance, support of peacekeeping and counter-narcotic operations.

The MQ-9 is equipped with a turbojet engine and can carry an internal payload of 750 lbs. to 60,000 ft. It is a significant improvement on the original Predator's 650 lb payload and 25,000 foot altitude. MQ-9 can carry an external payload of 3,000 lbs. Increased speeds allow it to transit and reposition quickly to new operating areas to provide critical and timely reconnaissance and targeting of ground activities.

MQ-9 carries a synthetic aperture radar (SAR) that is larger and more-capable than that carried by the MQ-1; a laser target designator; weapons and other detection systems. Additionally, it has an enhanced electro-optical/infrared (EO/IR) payload. Utilizing Ku-band satellite communication links, the tactical UAV can acquire and pass real-time imagery data to ground stations in adverse weather, day or night, and beyond-line-of-sight (BLOS). It is capable of mid-flight reprogramming and automatic take-off and landing. In the event of a data link loss, the MQ-9 is programmed to automatically return to its base of operations.

A typical configuration consists of four aircraft per ground control system, and one data distribution terminal. The Ground Control Station, a 30-foot trailer containing pilot and payload operator consoles, sends sensor data to the operational users. MQ-9 UAV systems are deployed from CONUS through multiple airlift sorties and require extensive disassembly and in-theater reassembly before operational employment.

Limitation:
- Susceptible to surface-to-air missiles, air-to-air missiles, anti-aircraft artillery, and jamming of satellite and line-of-sight links
- Not low observable
- Multiple sorties of C-130s, C-17s, and C-5s needed for air vehicle and ground station deployment
- Relatively slow moving

Performance

Category(ies)	Data
Armament/Payload/Sensor	Payload: internal, 750 lbs; external, 3000 lbs. Sensors: SAR, HSI or SIGINT, EO/IR, ESM. Weapons: 10 Hellfire, 2 GBU-38s, 2 CBU-38s or 103s, 8 SDB, 6 WASAAMM, or 6 Dominators. Also HARM, Maverick.
Dimensions	Length: 36 feet Span: 68 feet Height: 12 feet
Endurance	24 hours
Max T/O Weight	6,800 lbs Max Fuel load: 3000 lbs Payload with max fuel: 750 lbs
Operational Altitude	45,000 - 52,000 feet
Powerplant	One turbojet engine
Speed	Cruise: 198 kts Max: 220 kts
Support Crew	one pilot and two sensor operators in ground control station

System: Ground-Based Space Surveillance - Phased Array

Category: C4ISR
Function(s):
C4ISR
Counterspace

Long Description: Phased array radars use multiple independently controlled transmitter/receiver elements to form and steer radar beams. Phased array radars are capable of simultaneously tracking multiple objects, potentially up to 100 or more. Phased array radar arrays are typically fixed in direction (azimuth and elevation) and all beam steering is accomplished electronically. There is a limitation, however, in the amount of beam deflection from the 'boresight', perpendicular to the plane of the array. Typically, phased arrays for space surveillance can track in a 60 degree half-angle-cone centered about the boresight. To compensate for this limitation, fixed phased arrays have two or more array faces at different azimuths.

Outputs from phased arrays are metric observations and narrowband Space Object Identification (SOI) signatures. Metric observations are measurements of an object's position and velocity relative to the sensor site (e.g. time, elevation, azimuth, range, range rate, also known as TEARR data.) SOI signatures are measurements of an object's radar cross section versus time. Metric observations are used to locate objects and signatures are used to determine the object's size, general shape, and motion or orientation.

Phased array radars with a missile warning primary mission also contribute space surveillance data. However, in the event of missile attack, the space surveillance collateral mission is terminated.

Types of Phased Array Radar

Ballistic Missile Early Warning System (BMEWS) detects, tracks and provides tactical warning and attack assessment of ballistic missiles launched against the U.S., Canada, and the United Kingdom. BMEWs radars are located at three sites: Thule AB, Greenland; Clear AFS, Alaska; and RAF Fylingdales Moor, England.

The PAVE Phased Array Warning System (PAVE PAWS) radar is used primarily to detect and track sea-launched (SLBM) and intercontinental ballistic missiles (ICBMs). The system also has a secondary mission of Earth-orbiting satellite detection and tracking. Information received from the PAVE PAWS radar systems pertaining to

SLBM/ICBM and satellite detection is forwarded to the Missile Warning and Space Control Centers at Cheyenne Mountain Air Station, Colorado. Data is also sent to the National Military Command Center and the U.S. Strategic Command. PAVE PAWS radars are located at Cape Cod Air Force Station, Massachusetts, and Beale AFB, California.

The radar system is capable of detection and monitoring a large number of targets that would be consistent with a massive SLBM attack. The system must rapidly discriminate between vehicle types, calculating their launch and impact points in addition to the scheduling, data processing and communications requirements. The operation is entirely automatic, requiring people only for monitoring, maintenance and as a final check on the validity of warnings. Three different computers communicating with each other form the heart of the system, which relays the information to Cheyenne Mountain AS.

Perimeter Acquisition Radar Characterization System (PARCS) provides tactical warning and attack characterization of sea-launched and intercontinental ballistic missile attack against the continental United States. Missile warning data and assessment information is sent to the North American Aerospace Defense Command missile warning center at Cheyenne Mountain AS, Colorado. PARCs also supports the space surveillance network by providing space surveillance data, tracking, and reporting for space object identification. PARCs is a single-faced, phased array radar located at Cavalier Air Force Station, N.D.

The Eglin Space Surveillance Radar provides continuous surveillance of on-orbit satellites and tracks about 9,500 man-made objects in near-earth and deep space orbits per day. The radar provides the theater warfighter with advance knowledge of possible enemy intelligence-gathering satellites and their capabilities.

Limitation:

Performance

Category(ies)	Data
Capability	Radar Outputs: Metric Observations (TEARR data). SOI narrowband signatures
Coverage	Range Coverage: 10 km to 3,500 km line of sight Azimuth Coverage: 60 degrees about boresight Elevation Coverage: 60 degrees about boresight Range Accuracy: 50 meters Azimuth Accuracy: 0.005 degrees Elevation Accuracy: 0.005 degrees

System: Ground-Based Space Surveillance - Radar

Category: C4ISR
Function(s):
C4ISR
Counterspace

Long Description: Ground-Based Space Surveillance is a high-resolution, long-range, mono-pulse radar system, capable of high-accuracy tracking of objects in flight or in orbit. The operator of the system can select a single pulse output for target echo (skin) tracking or a coded pulse group for beacon tracking. The radar is capable of tracking targets at slant ranges from 500 yards to 32,768 nm.

Limitation:
- Susceptible to attack
- Limited line of sight

Performance

Category(ies)	Data
Capability	Radar Outputs: The radar produces metric observations (time, azimuth, elevation, range, and range rate), narrowband signatures, and wideband radar images. IRIG Phase II data format (240 bits), sync code, site address, azimuth, elevation, range, on target/off target flag, time, beacon/skin flag Radar Frequency: Can be either X, W, or UHF frequency
Coverage	Range Coverage: 0.24 nm (0.44 km) to 32,768 nm (60,686 km) line of sight Azimuth Coverage: 360 degrees Elevation Coverage: 3 to 90 degrees normal and from 90 to 180 in the plunge mode Range Accuracy: 5 yds Azimuth Accuracy: 0.0056 degrees or 5 ft at 10 miles Elevation Accuracy: 0.0056 degrees or 5 ft at 10 miles
Other	Radar Outputs: IRIG Phase II data format (240 bits), sync code, site address, azimuth, elevation, range, on target/off target flag, time, beacon/skin flag

System: HH-60X

Category: Special Operations Forces (SOF)
Function(s):
- Combat Search and Rescue
- Special Operations Employment

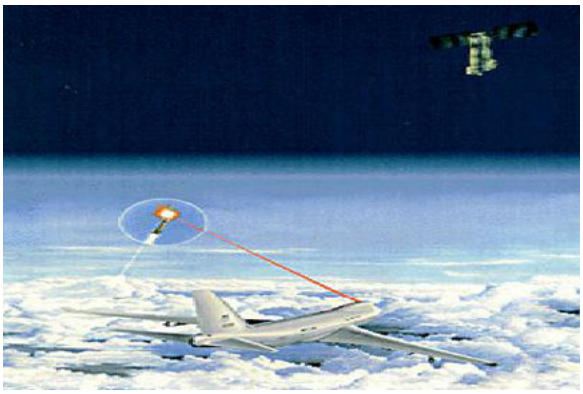
Long Description: The HH-60X conducts low-level, long-range combat search and rescue operations into hostile areas, day or night, in adverse weather. The HH-60X operates at longer ranges, in more dangerous weather, at higher altitudes, and in more rugged terrain than the previous HH-60G. The helicopter is equipped with two 7.62mm miniguns. HH-60Xs provide search and rescue coverage for US and coalition air forces in combat theaters around the world.

Limitation:
- Susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery
- Slow moving

Performance

Category(ies)	Data
Armament/Payload	Two 7.62 miniguns
Crew	Four: two pilots, a flight engineer, and gunner
Dimensions	Height: 16 feet, 8 inches Rotor Diameter: 53 feet, 8 inches
Max T/O Weight	22,000 lbs
Powerplant	2 General Electric T700-GE-01C
Range	445 NM
Speed	Max: 160 knots

System: Airborne Laser (AL-1)



Category: Directed Energy (DE)
Function(s):
- Counterair
- Counterspace

Long Description: The Airborne Laser (AL-1) consists of a High Energy Laser (HEL) housed in a new-build commercial 747-400F airframe. It possesses the capability to destroy theater ballistic missiles during boost phase at long-range. The AL-1 can put a beam on target several hundred kilometers away at the speed of light. Adjunct AL-1 missions include: defensive counterair (DCA) against air-breathing and missile threats (including limited cruise missile negation and self-protection), offensive counterspace, ground interdiction against limited target sets when used with EAGLE (TBMs and cruise missiles on TELs/launchers, POL and weapons depots, etc.), and optical imagery using the 1.5 m weapon telescope.

The AL-1 IR sensor suite provides 360 degree detection of missile launches. In clear weather, these sensors can detect launches on the ground. Under adverse weather conditions, these sensors will detect the missile when it breaks through the clouds. Since the AL-1 must engage a TBM while it is still in the boost phase with rocket motor(s) burning, the window of opportunity for engagements is 40-100 seconds (based on rocket burn time). Once the IR sensors detect a launch, the beam director is slewed to the target. Low power beacon (illuminating) lasers on the AL-1 are then fired at the missile to fine track and lock on the optimal missile target spot. The high power laser is fired at the missile causing heating of the target spot on the missile. Nominal engagement time is 5 seconds.

The AL-1 system significantly enhances the performance of other TBM defenses through real-time transmission of precise trajectory data on multiple launches. The AL-1's battle manager can simultaneously track 100 missiles in flight. Using this track information, the battle manager locates the launch and impact points for cueing of THAAD, midcourse intercept capability, and Patriot missile elements (for mid-course and terminal engagements). The AL-1 is capable of autonomous detection, acquisition, and tracking of ballistic missiles with no external cueing required, but it is fully equipped to exploit external cueing from, for example, space-based sensors. AL-1 can detect IR signatures and engage airborne targets, including cruise missiles and aircraft, in good weather. The aircraft is air-refuelable.

AL-1 is part of a "tiered architecture" of defenses arrayed against ballistic missiles. Six AL-1's support two orbits. AL-1 aircraft can shoot down ballistic missiles while working

with AWACS to direct F/A-22 fighters into an attack on the launching site.

Limitation:
- Extreme turbulence can affect beam quality on target (mitigated by adaptive optics)
- Limited susceptibility to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery
- Weather reduces the engagement window for target acquisition
- The AL-1 has no capability to engage rockets after burnout

Performance

Category(ies)	Data
Armament/Payload	One High Energy Laser: 20-40 shots (until 2010); 40-80 shots (post-2012) per sortie against ballistic missiles. Six hour turnaround (from ABL landing to ready for takeoff). Additional information available in classified annex.
Ceiling	Nominally 40,000 feet
Endurance	12 hours unrefueled
Powerplant	Four Pratt & Whitney PW4062, or four Rolls Royce RB2111-524H, or four GE CF6-80C215
Range	8,300 nm (13,360 km) unrefueled
Sensor	Infrared
Speed	547 knots (Mach 0.85)
Weight	875,000 lbs. (397,000 kg)

System: B-1 Bomber

Category: Strike
Function(s):
- Counterair
- Counterland
- Countersea
- Strategic Attack

Long Description: The B-1 is an all-weather, long-range, multi-role, precision strike aircraft capable of flying intercontinental missions without refueling. Offensive suite includes a synthetic aperture radar (SAR), inertial navigation system (INS), and a global positioning system (GPS) to navigate world-wide and bomb without using ground-based navigation aids. The B-1 possesses an integrated defensive system including radio frequency (RF) detection, jamming, and expendable countermeasures. Afterburning turbofan engines and swing-wing design give the B-1 great flexibility to vary altitude and speed based on mission requirements.

Carrying a variety of precision standoff and direct attack munitions, the B-1 can destroy point or area targets with great accuracy and mass. Using three internal bays, the B-1 can employ 54,000 pounds of ordnance -- the largest capacity for any US combat aircraft. In addition, mixed loads can be carried on the same mission, e.g., 28 Mk-82 500-pound GP bombs in forward bay, 10 CBU-87 cluster bombs in mid bay, and 8 JDAM 2000-pound GPS-aided bombs in aft bay.

Preferred B-1 CONOPs is deployment to a forward operating location (FOL) for sustained combat operations. Basing close to the area of responsibility (AOR) minimizes average sortie duration and maximizes target destruction rate. If immediate strike is required, the B-1 can also fly non-stop missions from the CONUS. The B-1's speed and agility provide seamless integration with composite force strike packages. Time-critical, mobile, and relocatable targets can be identified, tracked, and destroyed using the B-1s Ground Moving Target Indicator/Track (GMTI/GMTT) radar modes.

The Air Force plans to modify the B-1 to carry cruise missiles.

Limitation:
- Susceptible to surface-to-air missiles and air-to-air missiles
- Low altitude operations only in defended regions
- Significant and unique support tail required for deployment

Performance

Category(ies)	Data
Armament/Payload	3 internal weapons bays capable of accommodating up to 54,000 lbs of guided and unguided ordnance 84 x Mk-82 500 lb General Purpose bombs 84 x Mk-62 500 lb Quickstrike mines (land or sea) 30 x CBU-87 Combined Effects Munitions (CEM) cluster weapons 30 x CBU-89 Gator Mine cluster weapons 30 x CBU-97 Sensor Fused Weapons (SFW) 30 x CBU-103, CBU-104, CBU-105 Wind Corrected Munition Dispensors (WCMD) 24 x GBU-31 JDAM 2000 lb GPS-aided bombs (blast/frag or penetrator) 12 x AGM-154 JSOW 1000 lb GPS-aided glide cluster weapons 24 x AGM-158 JASSM 2000 lb precision standoff weapons 24 x Mk-84 2000 lb general purpose bombs
Ceiling	30,000 ft. (9,000 m)
Crew	4 officers (2 pilots, 2 weapon systems officer)
Max T/O Weight	477,000 lbs. (214,650 kg)
Other	Empty weight, approx. 192,000 lbs. (83,250 kg)
Powerplant	4 GE F101-GE-102 turbofan engines with afterburner
Range	6000 nm
Speed	782+ knots (Mach 1.25) at sea level

System: B-2 Spirit

Category: Strike
Function(s):
Command and Control

Long Description: The B-2 is a long-range, multi-role, air refuelable bomber that is capable of delivering nuclear or conventional munitions on intercontinental missions without refueling.

The B-2 capitalizes on "stealth" technology, having been designed to minimize observable radar, infrared, acoustic, visual, and electromagnetic emissions signatures. The airframe is constructed of high strength-to-weight composite materials. The design is a superficial, multi-span flying wing with an acute angle of sweepback on the leading edge and sharply pointed tips resulting from a change from 55 degrees of forward sweep to 55 degrees of aft sweep, allowing the aircraft to travel 6,000 nm without refueling.

This B-2 makes extensive use of smooth blended surfaces, and virtually the entire surface is covered with radar-absorbing materials, thus enabling the aircraft to have a radar cross-section of about one-tenth that of the B-1B and one-hundredth that of the B-52G. The aircraft is powered by 4 General Electric F118-GE-100 non-afterburning turbofan engines which produce 19,000 lbs. of thrust each. It is able to operate from airports with 10,000 ft runways. The crew consists of two pilots (a mission commander and a pilot).

The B-2 carries a wide variety of conventional or nuclear weapons in two side-by-side weapons bays. Each bay can house either one Rotary Launch Assembly (RLA) or two conventional Bomb Rack Assemblies (BRA). The B-2 is also capable of mine laying operations.

B-2 software upgrades allow the crew to receive and load a new set of misison data, as well as update missions in-flight.

Release 2.0 software for the Air Force Mission Support System (AFMSS) can generate a B-2 mission plan in eight hours. The Common Low Observable Auto-Router (CLOAR) generates an ingress route which minimizes exposure to hostile radars, given the targets, the known disposition of the radars, and the characteristics of the aircraft.

Weapon Integration: It is possible to integrate a new weapon on the B-2 without revising the basic operational flight program. Guided weapons can then be carried in any combination on the B-2, and can be mixed on the same rotary launcher and released in

any sequence (Generic Weapon Interface System - GWIS).

The B-2 conducts long-range power projection missions; Strike/deep attack/ interdiction of hard fixed and mobile targets. It can be used to halt an enemy attack by launching from CONUS and striking at such critical targets in the area of hostilities as air defenses, power grids, and armored vehicles, especially in the early stages of conflict.

Limitation:

- Must operate at night in order to maximize stealth characteristics; F/A-22 escort enables 24 hour stealth
- Relatively slow and unmaneuverable, making escape difficult if visually identified
- Requires 10,000 ft runway

Performance

Category(ies)	Data
Armament/Payload	Payload - 40,000 lbs. 2 weapons bay with rotary launchers carrying a variety of nuclear or conventional weapons, including 16 nuclear weapons; 16 GBU-31 JDAMS or a penetration BLU-109, or 16 Mk-84s (2000 lbs); up to 16 2,000 lb GBU-36/B (GPS Guided); up to 8 4,700 lb GBU-37 (GAM-113) near precision guided weapons; 192 SDB's (with SDB rack incorporated in 2004 - 72 prior to 2004), 16 JSOWs, or 16 JASSMs. Various other conventional weapons include Mk-82 500 lb bomb, M117 750 lb bomb, Mk-62 500 lb naval mine, and up to 32 CBU 87/89/97 cluster bombs. The B2 can carry 80 JDAM-82's with the S-BRA.
Ceiling	50,000 feet
Combat Radius	2500 NM
Crew	2, mission commander and pilot
Dimensions	Length: 69 feet Width: 172 feet Height: 17 feet
Max T/O Weight	336,500 lbs; Empty - 125,000 - 153,700 lbs
Powerplant	4 General Electric F-118-GE-100 engines
Range	5,000 NM
Speed	Cruise: 400 knots

System: B-52H Stratofortress

Category: Strike
Function(s):
- Counterair
- Counterland
- Countersea
- Electronic Warfare
- Strategic Attack

Long Description: The B-52 is an air refuelable long-range bomber aircraft capable of performing a variety of missions, including show of force, maritime interdiction, strategic attack, precision strikes, and defense suppression. It provides massive firepower in low-threat environments with a standoff attack capability for high-threat environments. It is capable of dropping large quantities of gravity bombs or high-altitude multiple cruise missile launches. Highly effective when used for ocean surveillance, and can assist the Navy in anti-ship and mine-laying operations. All B-52s are equipped with Doppler tail-warning radar, an electro-optical viewing system, as well as high resolution low-light-level television sensors to augment the targeting, battle assessment, flight safety, and terrain-avoidance system, thus further improving its combat ability and low-level flight capability. On-going modifications incorporate the GPS, heavy stores adapter beam for carrying 2,000-pound munitions, and additional smart weapons capability. Other upgrades include the installation of secure radios, MIL-STD-1760 interfaces, and the addition of a 3rd AN/ALQ-172 EWS. B-52 uses FLIR, LLLTV sensors Phase VI avionics, as well as TERCOM and INS/GPS guidance systems. The aircraft is capable of carrying a wide range of munitions, including ALCMs (Nuclear), AGM-86Cs (CALCMs), ERCMs, LRCMs, ACMs (AGM-129s), naval mines and JDAM, JSOW, Wind-Corrected Munitions Dispenser, and JASSM. Employs standoff weapons outside of defended areas, and can use direct attack or glide munitions over less-defended targets. A universal bomb-bay adapter improves speed and safety in switching from nuclear to conventional weapons. The B-52 has an unrefueled range in excess of 8,800 miles (12,000 km). It is capable of protecting itself against a full range of air-defense threat systems by using a combination of electronic detection, jamming, and infrared countermeasures. It supports overall strategic attack working in conjunction with cruise missiles, F-15Es, B-2s, and B-1Bs, and is used for power projection and presence along with other strike/deep attack/interdiction elements.

Stand-off Jammer (SOJ) variant: The B-52 SOJ carries one extremely high-power EW pod on each wing in place of an external fuel tank. Modification of the aircraft includes an upgrade to the EW suite. Long range, long loiter time, and a dedicated Electronic Warfare

Officer on the crew contribute to a persistent stand-off jamming capability that provides SOJ screening for both stealthy and non-stealthy assets operating in alignment with the B-52 SOJ. While employed in an electronic attack role, the B-52 SOJ maintains its weapons capabilities to serve either EW or non-EW functions.

Limitation:

- Susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery
- Large radar and IR signatures; lack of stealth decreases overall system survivability in high-risk threat environments
- Limited self-defense capability

Performance

Category(ies)	Data
Armament/Payload	Nuclear weapons: 12 AGM-129A ACMs or AGM-86B ALCMs (external) w/ 8 freefall bombs or 8 AGM-86B ALCMs (internal). Conventional weapons include 12 JDAMs, JASSMs, or JSOWs; 16 WCMDs; 8 GBU-10 or 10 GBU-12 LGBs; 4 GBU-28 LGBs; 8 CALCMs, ERCMs or LRCMs; 24 CBU-87/89 cluster bombs; 16 MK-56 sea mines; up to 45 MK-62/63/65 QS mines; and up to 45 GP bombs (Mk-82/84 or M-117s). Certain aircraft carry 3-4 AGM-142A HAVE NAPs or 8 AGM-84 Harpoons.
Ceiling	50,000 feet
Combat Radius	2900 NM
Crew	5: 2 pilots, navigtor, radar navigator and electronic warfare officer
Dimensions	Length: 160 feet Span: 185 feet Height: 48 feet
Max T/O Weight	488,000; empty - 188,000 lbs
Powerplant	8 Pratt and Whitney TF22-P-3 turbofans
Range	7650 NM

System: EC-130 Commando Solo

Category: Information Operations
Function(s):
- Command and Control
- Intelligence
- Special Operations Employment

Long Description: The EC-130 Commando Solo aircraft conducts psychological and civil affairs broadcast operations, operating in standard civil and military communications bands. Missions are flown at maximum altitudes to ensure optimum propagation patterns. The EC-130 flies during either day or night scenarios with equal success and is air refuelable. A typical mission consists of a single-ship orbit that is offset from the desired target audience, either military or civilian personnel. Secondary missions include command and control communications countermeasures (C3CM) and limited intelligence gathering.

The EC-130 has been modified to include enhanced navigation systems, self-protection equipment, and the capability of broadcasting color television on a multitude of worldwide standards throughout the TV VHF/UHF ranges.

Limitation: - Susceptible to surface-to-air missiles, air-to-air missiles, anti-aircraft artillery, and jamming

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Performance

Category(ies)	Data
Ceiling	30,500 feet
Crew	Four flight crew and 15 mission personnel
Dimensions	Length: 99 feet Span: 133 feet Height: 38
Max T/O Weight	175,000 lbs
Powerplant	Four Rolls Royce - Allison AE2100D
Range	3400 NM
Speed	342 knots

System: EC-130 Compass Call

Category: Information Operations
Function(s):
- Counterinformation
- Special Operations Employment

Long Description: The EC-130 Compass Call is the designation for a modified version of the Lockheed C-130 Hercules aircraft configured to perform tactical command, control, and communications countermeasures or C3CM. The aircraft uses noise-jamming to prevent communication or degrade the transfer of information essential to command and control of weapons systems and other resources. The Compass Call primarily supports tactical air operations but is capable of providing jamming support to ground force operations. Modifications to the aircraft include an electronic countermeasures system (Rivet Fire), air-refueling capability, and associated navigation and communications systems. Together with the F-16 and the EC-130H, the EC jams targets, inserts deception to confuse the enemy, and destroys critical targets. The EC-130H carries a combat crew of 13 people. Four are responsible for aircraft flight and navigation. Nine crew members operate and maintain the Rivet Fire equipment. The mission crew consists of an EW officer, who is the mission crew commander (MCC). An experienced cryptologic linguist is the mission crew supervisor (MCS). Six analysis operators and an airborne maintenance technician complete the crew. Aided by the automatic system, the crew members of the EC-130H analyze the signal environment, designate targets, and ensure the system is operating effectively. Targets can be designated before the mission takes off, acquired in flight, or the MCC/MCS can receive additional tasking at any time from outside agencies such as Airborne Warning and Control System, RC-135, and Airborne Command, Control, and Communications System (ABCCC). The aircraft is tasked by all the unified commands and, therefore, subject to worldwide deployment in support of tactical air/ground forces on very short notice.

Limitation: - Susceptible to surface-to-air missiles, air-to-air missiles, anti-aircraft artillery, and jamming

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Performance

Category(ies)	Data
Ceiling	25,000 feet
Crew	13 (4 flight crew, 9 mission crew)
Dimensions	Length: 99 feet

	Span: 133 feet Height: 38 feet
Max T/O Weight	155,000 lbs
Powerplant	4 Allison T56-A-15 turboprops
Range	> 1825 NM
Speed	325 knots 20,000 feet

System: Ground-Based Radio Frequency (RF) Jammer

Category: Munitions
Function(s):
- Counterinformation
- Counterspace

Long Description: The Ground-Based Radio Frequency (RF) Jammer is a mobile system designed to perform space control operations. This system employs multi-bands through adaptable aperture technology for brute force or smart jamming against uplink Telemetry, Tracking, and Commanding (TT&C). It has a limited capability to jam the downlink of TT&C and mission data. In addition, the RF Jammer can conduct SIGINT collection.

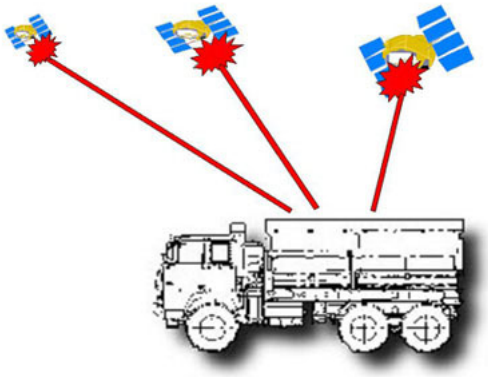
The RF Jammer is truck-mounted and can be deployed aboard a C-5B or C-17. Both the jammer and its power supply are garrisoned in CONUS and deployed to the theater upon crisis or conflict conditions. A space surveillance database is required for targeting. Once deployed, RF Jammer units receive daily updates of the space surveillance database.

Limitation:
- Easily targeted by enemy forces
- Low Earth Orbit (LEO) effectiveness requires close proximity to adversary
- Possibility of jamming friendly systems

Performance

Category(ies)	Data

System: Theater Laser Dazzler



Category: Munitions
Function(s):
Counterinformation

Long Description: The Theater Laser Dazzler is a mobile system used to perform space control operations by employing selectable, multi bands to temporarily deny both Visible and Infrared (IR) systems by blinding the sensors. The system is housed in a multi-purpose vehicle containing computers to calculate orbits, control the laser-designator for daytime tracking operations (active tracker), control the return energy sensor for use with an active laser tracker, drive the laser mount system, and interface with other tracking and sensor systems. Typical targets for the Theater Laser Dazzler include any Low Earth Orbit (LEO) ISR, weather, EO, or IR satellites. Each system uses a set of solid-state lasers (low-medium power), which, if connected to an electrical supply, can fire for an indefinite amount of time.

There are many different variants of the Theater Lazer Dazzler including truck/trailer mounted, HMMWV mounted, or man-portable "telescope" systems. All are easily transportable. The Theater Laser Dazzler is used with the Ground-Based RF Jammer to deny enemy ISR assets. The system requires a space surveillance database for targeting and once deployed, Laser Dazzler units receive periodic (at least daily) updates of the database.

Limitation:
- Laser must be located in a central area of the AOR which the Combatant Commander wishes to be denied
- Enemy satellite systems may still be capable of limited viewing of the area in an "off-axis" manner
- Laser system is vulnerable to ground and air attack (system has limited non-laser self-defenses and is not armored)
- Weather can adversely affect or prevent effective operations (laser will not penetrate cloud cover)
- Laser will have no impact on Synthetic Aperture Radar (SAR) imagery

Performance

Category(ies)	Data

System: C-130H Hercules

Category: Mobility / Refueling
Function(s):
Airlift

Long Description: The C-130H Hercules primarily performs the intra-theater portion of the tactical airlift mission. The aircraft is capable of operating from rough dirt strips and is the prime transport for paradropping troops and equipment into hostile areas. The C-130 is powered by four Allison T56-A-15 turboprop engines, producing 4,300 horsepower per engine. Each engine drives a Hamilton Standard type 54H60 four-blade constant-speed, fully feathering, reversible-pitch propeller. Fuel is stored in six internal tanks in the wings with a total capacity of 6,960 gallons (26,344 liters). Two underwing pylon tanks, each with a capacity of 1,360 gallons (5,146 liters) are optional. This fuel capacity gives the C-130 a range of 2,356 miles with maximum payload. All flight control systems are boosted by dual hydraulic units.

In its personnel carrier role, the C-130 can accommodate 92 combat troops or 64 fully equipped paratroops on side-facing seats. For medical evacuations, it carries 74 litter patients and two medical attendants. Paratroopers exit the aircraft through two doors on either side of the aircraft behind the landing-gear fairings. The main exit is an hydraulically operated loading door and ramp at the rear of the cabin. The C-130 can air transport and airdrop loads of over 42,000 lbs (19,051 kg), including Sheridan light armored vehicles, light and medium towed artillery weapons, a variety of wheeled and tracked vehicles, or five 463L supply pallets. The C-130H Hercules conducts mercy flights throughout the world, bringing in food, clothing, shelter, doctors, nurses, and medical supplies and moving victims to safety.

The crew consists of two pilots, a navigator, a flight engineer, and a loadmaster. Accommodations aboard the C-130 include sleeping bunks for relief crew and a galley. The flight deck and main cabin are pressurized and air-conditioned.

The C-130 conducts humanitarian relief missions and can be utilized for medical evaluations. It supports ground operations through the delivery of troops and equipment to forward bases of operation through its' ability to deliver paratroopers and equipment to austere runways. The Hercules is used in conjunction with the C-5 and C-17 to enhance global airlift capability.

Limitation: - Relatively slow and unmaneuverable

- Susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery

Performance

Category(ies)	Data
Armament/Payload	45,000 lbs up to 92 ground troops; 64 paratroopers; 74 litter patients and attendants; 54 passengers on palletized seating; or up to five 463L standard freight pallets.
Ceiling	33,000 feet @ 100,000 lb
Crew	Five
Dimensions	Length: 99 feet Span: 133 feet Height: 38 feet
Max T/O Weight	155,000 lbs; max load - 45,000 lbs
Powerplant	H- 4 Rolls Royce Allison T56-A-15 Turboprops J - 4 Rolls Royce Allison AE210003 Turboprops
Range	3,450 NM; 2,240 NM with 40,000 lbs
Speed	Max: 370 knots Cruise: 270 knots

System: C-130J Hercules

Category: Mobility / Refueling
Function(s):
Airlift

Long Description: The C-130J Hercules is an upgraded version of the C-130H, designed to perform intratheater tactical airlift. The C-130J is more fuel-efficient, giving it a greater range and expanded capabilities. The C-130J is powered by four 6,000 horsepower Allison AE2100D3 turboprop engines that utilize a six-bladed, flange-mounted, electronically controlled, all composite Dowty propeller. These more powerful engines increase the C-130's ceiling to 42,000 ft. (compared to the C-130H's ceiling of 33,000 ft.). These new engines are equipped with new propeller options allowing continued propeller/engine operation on the ground with the blades in a feather position. This allows the aircraft to on/off-load troops or equipment with no propeller blast.

The C-130J has all-digital avionics and mission computers. Nearly all of the gauges are now displayed on computer screens, and the pilot can select between several optimum displays during different phases of the flight. The C-130J has increased reliability and maintainability, reducing the cost of ownership by as much as 45% depending on the scenario for use.

All C-130Js have an All-Weather Aerial Delivery System (AWADS) capability as opposed to only 50 C-130E/Hs. An integrated digital technology provides the capability to airdrop in instrument conditions without zone markers. Coupling the high resolution ground-mapping capability of the APN-241 Low Power Color Radar with the dual INS/GPS and digital mapping systems gives the C-130J single-ship or formation all-weather aerial delivery. The cargo component includes integral flip-over roller conveyors and a dual row, right/left centerline Container Delivery System (CDS) with Center Vertical Restraint (CVR) rails. A variable speed, electric winch is flush-mounted in the front cargo compartment floor. The cargo ramp and door opening are designed to open at 250 knots, allowing for high speed target ingress/egress.

The C-130J conducts humanitarian relief missions and can be utilized for medical evaluations. It supports ground operations through the delivery of paratroopers and equipment to austere runways at forward bases. The Hercules is used in conjunction with the C-5 and C-17 to enhance global airlift capability.

Limitation: - Relatively slow and unmaneuverable

- Susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery

Performance

Category(ies)	Data
Armament/Payload	Approximately 42,673 lbs. (19,356 kg): 92 troops or 64 paratroops or 74 litter patients or five standard freight pallets
Ceiling	42,000 ft. (12,800 m)
Crew	Five (two pilots, a navigator, flight engineer, and loadmaster)
Max T/O Weight	161,000 lbs. (60,091 kg)
Powerplant	Four Allison AE 2100D3 turboprop engines
Range	Unrefueled: 1800 nm
Speed	Cruise Speed: 320 knots

System: C-17 Globemaster III

Category: Mobility / Refueling
Function(s):
Airlift

Long Description: The C-17 is a versatile, air refuelable long-range transport aircraft. It is capable of rapid strategic delivery of troops and all types of cargo to main operating bases or directly to forward bases in a deployment area. It performs both theater airlift missions and cargo drop operations. The thrust reversers give it the ability to back down runways and turn in a tight radius, allowing it to operate in cramped spaces. This feature also directs the flow of air upward and forward to avoid the ingestion of dust and debris and the disruption of ground personnel operations.

Cargo is loaded onto the C-17 through a large aft door that accommodates paratroopers, vehicles, palletized loads, roll-on/roll-off shipments, airdrop, and medical evacuation. The design of the C-17 allows it to operate on austere runways which are unpaved and can be as narrow as 90 ft. wide. The airplane has demonstrated its ability to land on a semi-prepared dirt field, unloaded while keeping engines running, and taken off within thirty minutes.

The C-17 improves the ability of the total airlift system to fulfill the worldwide air mobility requirements of the US. In conjunction with other lift assets, the C-17 maintains US power projection capabilities.

Limitation: - Susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery

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Performance

Category(ies)	Data
Armament/Payload	102 troops/paratroops; 36 litters and 102 ambulatory patients and attendents; 164,000lbs of cargo; defensive systems include flares and LAIRCM.
Ceiling	45,000 feet
Crew	Three: pilot, copilot, loadmaster
Dimensions	Length: 174 feet Span: 170 feet Height: 55 feet
Max T/O Weight	585,000 lbs Max Payload: 170,900 lbs

	Empty: 277,000 lbs
Powerplant	4 Pratt & Whitney F117-PW-100 turbofan engines with 40,440 lbs of thrust
Range	Unrefueled: 6,200
Runway Requirements	Capable of landing with heavy loads on runways of <3000 ft
Speed	Mach .825

System: C-5 Galaxy

Category: Mobility / Refueling
Function(s):
Airlift

Long Description: The C-5 is a heavy cargo transport aircraft designed to provide massive airlift for deployment of combat and support forces. The C-5 provides rapid strategic delivery of troops and cargo to main operating bases and performs cargo drop operations. It can carry a large and heavy cargo for intercontinental ranges. The C-5 can take off and land in relatively short distances and taxi on substandard surfaces during emergency operations. Using the front and rear cargo openings, it can be loaded and off-loaded at the same time. Drive-in loading and unloading of wheeled and tracked vehicles is possible. The Galaxy is almost as long as a football field, is as high as a six-story building and has a cargo compartment about the size of an eight-lane bowling alley. Thirty-six fully loaded pallets can be loaded aboard in about 90 minutes. The C-5 does not carry troops in the lower-deck cargo compartment but 73 seats are available in the rear compartment of the upper deck for personnel and operators of the equipment. It has carried special loads, such as large missiles, that would require extra time, manpower, and dollars to transport via ship, rail, or flatbed truck. It is the only aircraft that can transport any Army combat item, including the 74-ton (66,600 kg) mobile scissors bridge, tanks, and helicopters. The forward upper deck accommodates a crew of six, a relief crew of seven, and eight mail or message couriers. The Galaxy has sophisticated communications equipment and a triple inertial navigation system, making it nearly self-sufficient. It can operate without using ground-based navigational aids. The electrical system has four engine-driven generators, each powerful enough to supply the aircraft sufficient electricity.

Additionally, the Air Force has contracted for a system development and demonstration program for a Reliability Enhancement and Re-engining Program (RERP) to enhance service life for a limited number of C-5's.

Limitation:
- Susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery
- Limited availability of suitable landing fields

Performance

Category(ies)	Data
Armament/Payload	395,000 lbs (wartime: 466,000 lbs)

Ceiling	45,000 ft 34,000 ft. (10,363 m) with a 605,000 lbs. (272,250kg) load
Crew	6 / 2 loadmasters
Max T/O Weight	769,000 lbs. (346,500 kg)
Other	Weight: 374,000 lbs. (147,528 kg) empty
Powerplant	Four General Electric TF39-GE-1C Turbofan engines
Range	w/ Max Payload: 2984 NM w/ Max Fuel: 6296 NM
Speed	.77 Mach

System: KC-10A Extender

Category: Mobility / Refueling
Function(s):
Air Refueling

Long Description: The KC-10A is a long-range air-refueling aircraft that enables power projection missions and supports the rapid deployment of forces for combat missions or Small-Scale Contingencies (SSCs). In its secondary airlift role, it can transport up to 75 people and approximately 170,000 lbs (76,560 kg) of cargo a distance of roughly 4,400 miles (7,040 km). Without cargo, the KC-10A's unrefueled range is more than 11,500 miles. The KC-10A is capable of simultaneously refueling fighters while carrying support personnel and equipment. Using either an advanced aerial refueling boom, or a hose and drogue refueling system, the KC-10A can refuel a wide variety of U.S. and allied military aircraft. It is equipped with special lighting for night operations.

Limitation: - Susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery

Performance

Category(ies)	Data
Armament/Payload	Additional seating possible for up to 75 w/ 17 pallets Max 27 pallets Max payload 169,400 lbs
Ceiling	42,000 feet
Crew	4 (aircraft commander, pilot, flight engineer, and boom operator)
Dimensions	Length: 182 feet Span: 165 feet Height: 58 feet
Max T/O Weight	593,000 lbs
Powerplant	Three General Electric CF-6-50C2 turbofans
Range	4,400 NM w/ max cargo
Refueling Capability	Fuel Takeoff Load: 353,600 lbs Fuel Offload: 195,200 lbs at 1000 NM mission radius
Speed	Cruise - Mach .825

System: KC-135 Stratotanker

Category: Mobility / Refueling
Function(s):
Air Refueling

Long Description: The KC-135 Stratotanker is a key enabler for the nation's global power projection capabilities. The KC-135 provides aerial refueling support to Air Force, Navy, Marine Corps, and allied aircraft. The aircraft is powered by four turbofan engines mounted under wings swept 35 degrees. Nearly all internal fuel can be pumped through the tanker's flying boom, the KC-135's primary fuel transfer method. A special shuttlecock-shaped drogue, attached to and trailed behind the flying boom, is used to refuel aircraft fitted with probes. The drogue can only be installed or removed on the ground. An operator stationed in the rear of the plane controls the boom. A cargo deck above the refueling system holds passengers or cargo. Depending on fuel storage configuration, the KC-135 can carry up to 83,000 lbs (37,350 kg) of cargo or approximately five pallets.

The R model has a more powerful and fuel-efficient engines capable of offloading more fuel. In addition, the R model fleet is currently being upgraded with PACER CRAG. This modification installs a glass cockpit, Traffic Alert and Collision Avoidance System (TCAS), and eliminates the navigator crew position for all but special operations missions. (A minimal roll-on Nav station can be installed for special operations mission.) Finally, a limited number of aircraft will fleet will receive the Roll On Beyond-Line-Of Sight Enhancement (ROBE) in 2004. This modification will allow the tanker to function as a translator, or gateway, between various tactical datalink formats, and provide a transmission uplink to satellites allowing worldwide visibility of information.

Limitation: - No defensive systems; susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery

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Performance

Category(ies)	Data
Ceiling	50,000 feet
Crew	Standard Crew: 4 (2 pilots, 1 nav, 1 boom operator) R/PACER CRAG: 3 (2 pilots and 1 boom operator)
Dimensions	Length: 136 feet

	Span: 131 feet
	Height: 38 feet
Max T/O Weight	322,500 lbs
	119,00 lbs empty
Powerplant	R model: 4 CFM Intl F108-CF-100 Turbofans
	E model: 4 Pratt & Whitney TF-33-PW-102 Turbofans
Range	11,015 NM with max fuel
	2,500 NM average
Refueling Capability	Fuel Takeoff Load: 212,200 lbs
	Fuel Offload: 99,400 lbs at 100 NM mission radius
Speed	419 knots cruise
	530 knots at 30,000 feet

System: KC-767A

Category: Mobility / Refueling
Function(s):
Air Refueling

Long Description: The KC-767A is a modified commercial wide-body transport. The KC-767A is capable of performing tanker and cargo transport. It has both an aeriel refueling boom and centerline hose drum unit, making it fully capable of refueling any receptacle or probe-equipped aircraft on the same mission.

The KC-767A can be modified to accommodate refueling wing pods and/or a centerline refueling hose for probe and drogue refueling, a centerline boom, or any combination of those configurations. The aircraft is able to provide refueling support for the full range of US military aircraft. The KC-767A has a large, side fuselage door that provides access to the cargo compartment for the loading of a wide range of palletized equipment.

In addition to the air-refueling mission, the KC-767A will supplement the ISR and communications relay mission as part of its spiral development by the addition of the Multi-Mission Payload (MMP). The MMP will enable passive Signals Intelligence (SIGINT) collection and dissemination, communications relay, and data-link translation in support of the Multi-Sensor Command and Control (MC2C) Constellation and ground-based Theater Air Control System elements. SIGINT will include communications intelligence (COMINT) and electronic intelligence (ELINT). The system will be used for improved situational awareness (SA), High Value Asset (HVA) protection and BLOS communications during on-station or enroute operations. The C2ISR package will become a key enabler in the development of BLOS communications and airborne components of the Global Information Grid (GIG). As part of the planned spiral developments, the KC-767A may incorporate wing air refueling pods that will enable refueling of two probe equipped aircraft simultaneously and Large Aircraft Infrared Countermeasures (LAIRCM) for protection from IR guided SAMs and shoulder fired missiles.

Limitation:
- Susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery
- Cannot air deliver cargo
- Requires MHE to offload cargo from high fuselage

Performance

Category(ies)	Data
Ceiling	43,000 feet
Crew	3 (2 pilots, 1 boom operator)
Dimensions	Length: 232 feet Span: 196 feet Height: 55 feet
Max T/O Weight	450,000 lbs
Powerplant	2-4 Pratt and Whitney PW 4062 or GE CF6-80C2B8F
Range	8,000 nm
Refueling Capability	109,400 lbs at 1,000 nm radius (MTOGW/8,000 runway)
Speed	439 knots

System: AIM- 7 Sparrow

Category: Munitions
Function(s):
- Command and Control
- Intelligence
- Reconnaissance
- Surveillance

Long Description: The AIM-7 Sparrow is a supersonic, medium-range, radar-guided, air-to-air missile with a high-explosive warhead. The Sparrow has all-weather, all-altitude operational capability and can attack high-performance aircraft and missiles from any direction. It is a widely deployed missile used by U.S. and North Atlantic Treaty Organization forces.

The AIM-7 (series) is used primarily to neutralize the threat of high performance enemy aircraft. The missile has five major sections: radome, radar guidance system, warhead, flight control (autopilot plus hydraulic control system), and solid propellant rocket motor. It has a cylindrical body with four wings at mid-body and four tail fins. The missile guides on radio frequency energy, processing radar signals received via its rear signal receiver from the launch platform's radar system and reflected target energy received directly from the target. The AIM-7M/P is controlled in flight by four movable delta platform wings. Missile stability is provided by four fixed delta fins which are located in-line with the forward wings. Missile propulsion is provided by a dual-thrust, solid propellant rocket motor. An active radio frequency fuze detonates the warhead when the missile is within lethal range of the target. The Sparrow also contains Defensive Counter Countermeasure capabilities that include Electronic Protection from Electronic Attack.

Limitation: The aircraft that fires the AIM-7 is required to continue painting the target with radar, limiting that aircraft to straight and level flight

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Performance

Category(ies)	Data
Dimensions	LENGTH: 12 ft (3.64 m)
Guidance	Semi-active radar homing
Propulsion	Hercules MK-58 solid-propellant rocket motor
Range	30 nm (56 km)
Speed	Classified
Warhead	Annular blast fragmentation warhead of 88 lbs HE

Weight	Approximately 500 lbs (225 km)

System: AIM- 9 Sidewinder

Category: Munitions
Function(s):
- Counterinformation
- Counterspace

Long Description: The AIM-9 Sidewinder is a supersonic, heat-seeking, air-to-air missile carried by fighter aircraft. It has a high-explosive warhead and an active infrared guidance system. The AIM-9 has a cylindrical body with a roll-stabilizing rear wing/rolleron assembly. Also, it has detachable, double-delta control surfaces behind the nose that improve the missile's maneuverability. Both rollerons and control surfaces are in a cross-like arrangement. An infrared homing guidance section, an active optical target detector, a high-explosive warhead, and a rocket motor are the missile's main components. The infrared guidance head enables the missile to home on target aircraft engine exhaust. An infrared unit costs less than other types of guidance systems, and can be used in day/night and electronic countermeasures conditions. The infrared seeker also permits the pilot to launch the missile, then leave the area or take evasive action while the missile guides itself to the target.

Limitation:
- Range is limited by the ability to detect IR signatures
- Minimum range-to-arm limitations
- Foreign IR stealth designs
- Limits on ability to successfully ignore enemy infrared countermeasures and discriminate enemy aircraft from background infrared

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Performance

Category(ies)	Data
Dimensions	9 ft, 5 inches (2.87 m)
Propulsion	Hercules and Bermite Mk 36 Mod 71, 8 solid-propellant rocket motor
Range	5-8 nm (9.26-15 nm) depending on altitude
Speed	1,610 knots (Supersonic Mach 2.5)
Warhead	Annular blast fragmentation warhead 25 lbs high explosive for AIM-9H 20.8 lbs high explosive for AIM-9L/M
Weight	190 lbs (85.5 km)

System: AIM- 9X Sidewinder

Category: Munitions
Function(s):
Counterair

Long Description: The AIM-9X is the follow-on to the AIM-9 Sidewinder. It is a highly maneuverable, heat-seeking, short-range air-to-air, launch-and-leave, air combat munition carried by fighter aircraft. It can be used for both offensive and defensive operations. The AIM-9X's advanced design provides full day/night capability, resistance to countermeasures, high off-boresight improvements, and increased maneuverability.

The AIM-9X is powered by a solid fuel MK36 reduced-smoke rocket motor that propels it at approximately Mach 5. The engine utilizes thrust vector control, which significantly increases maneuverability. The airframe is composed of a low-diameter missile body with small control surfaces at the tail which are supported by jet rudders. This high performance airframe coupled with the rocket motors give the AIM-9X an extreme turning capability, high speed, and increased range. These characteristics significantly widen the spectrum of angles from which the missile can attack while increasing the no-escape-zone of the enemy.

The missile can be targeted and controlled with a helmet-mounted sight. The AIM-9X uses passive infrared energy for tracking. The seeker uses an imaging infrared focal plane array comprised of a 512 by 512 cell area. A swivable casing for the seeker head, instead of the traditional dome head, allows extreme angles of view for the detector, thus increasing its ability to distinguish heat structures. The seeker/sensor information is processed using an advanced signal processor onboard the missile.

The AIM-9X is also equipped for improved defense against infrared countermeasures and possesses enhanced background discrimination capability. These characteristics increase its ability to locate and lock on a target and decrease the missile's risk of detection.

The AIM-9X provides an all-weather, all-environment, air-to-air, first-kill capability. It complements longer-range radar guided missiles such as the AMRAAM.

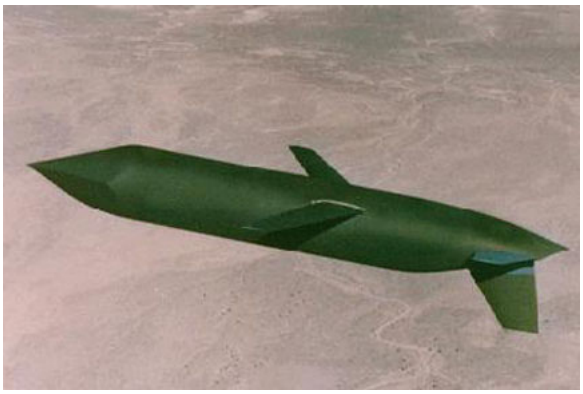
Limitation:
- Range is limited by the ability to detect IR signatures
- Minimum range-to-arm limitations
- Foreign IR stealth designs

- Limits on ability to successfully ignore enemy infrared countermeasures and discriminate enemy aircraft from background infrared

Performance

Category(ies)	Data
Accuracy	See Classified Annex
Dimensions	Length: 119 inches Diamter: 5 inches
Guidance	Imaging Focal Plane Array (FPA) Infrared (IR) Sensor with improved countermeasure capability
Launch Platform(s)	F-16C, F-15C, F/A-22, F-35 externally
Propulsion	MK36 Solid Rocket or Composite Case
Range	See Classified Annex
Warhead	21 lbs Blast/Fragmentation
Weight	188 lbs

System: AGM-129A Advanced Cruise Missile (ACM) - Nuclear



Category: Munitions
Function(s):
Strategic Attack

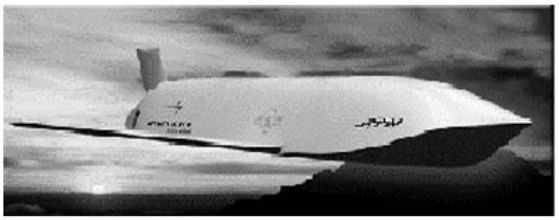
Long Description: The ACM is an air-to-ground cruise missile developed to provide a long-range, highly survivable, strategic standoff weapon. The AGM-129A is designed with a distinctive forward swept wing and radar absorbing materials to give it a low radar cross section and increased ability to penetrate enemy defenses. It is powered by a F112-WR-100 advanced, twin-shaft, axial flow fan engine. This engine is compact, lightweight, and incorporates radar- absorbing materials and other Low Observable (LO) technologies, further adding to the missile's stealth characteristics. Once in flight, the missile is guided by an inertial guidance system that is augmented with laser sensor updates, greatly enhancing navigation accuracy. The ACM can be deployed from a variety of large bomber aircraft.

Limitation: - Does not provide conventional capability

Performance

Category(ies)	Data
Accuracy	See classified annex
Dimensions	Length: 250 in Diamter: 120 in
Guidance	Inertial navigation, with TERCOM update
Launch Platform(s)	B52H
Propulsion	F112-WR-100 Turbofan
Range	2000 NM
Speed	Cruise: 434 knots
Warhead	W-80-1
Weight	3600 lbs

System: AGM-158 Joint Air-to-Surface Standoff Missile (JASSM)



Category: Munitions
Function(s):
Counterland

Long Description: The Joint Air-to-Surface Standoff Missile (JASSM) is a new generation, low-risk cruise missile system that is designed to attack high priority targets at ranges beyond that of enemy air defenses.

This missile weighs less than 2,250 lbs and carries a single unitary warhead. It is designed to accommodate future advances in warheads, seekers, and propulsion. JASSM is launched from a variety of bombers and fighter aircraft including the F-16C/D, F/A-18E/F, F-15E, F-117, F-35, B-1B, B-52H and B-2. After launch, it flies over a low-level, circuitous route to the area of a target, where an autonomous terminal guidance system guides the missile to the target ensuring precision attack.

JASSM's midcourse guidance is provided by a Global Positioning System (GPS)-aided inertial navigation system (INS) protected by a new high, anti-jam GPS null steering antenna system. In the terminal phase, JASSM is guided by an imaging infrared seeker and a general pattern match-autonomous target recognition system that provides aimpoint detection, tracking and strike.

Limitation:

Performance

Category(ies)	Data
Accuracy	See Classified Annex
Dimensions	Length: 168 inches Diameter: 21 inches (wings closed) Width: 25 inch with wings closed, 120 inch wings deployed
Guidance	Imaging; Infrared Radar
Launch Platform(s)	B-1B, B-52H, F-16, F-117, F-15E, B-2 Navy: F-18, S-3, P-3
Propulsion	J 402 Teledyne Engine
Range	> 200 NM
Speed	Cruise: .8 Mach
Warhead	Unitary

Weight	< 2250 lbs

System: AGM- 86B Air-Launched Cruise Missile (ALCM)-Nuclear

Category: Munitions
Function(s):
- Counterland
- Strategic Attack

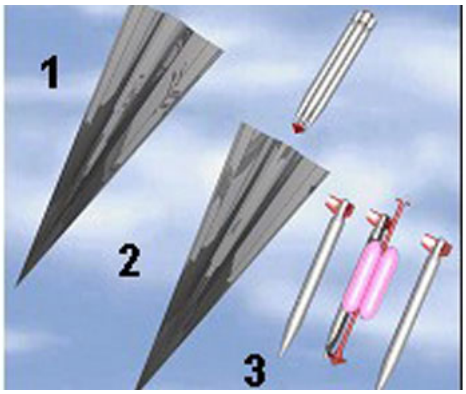
Long Description: The AGM-86B air-to-ground strategic cruise missile was developed to increase the effectiveness of B-52H bombers to attrit an enemy's forces and complicate defense of its territory. The small, winged AGM-86B missile is powered by a turbofan jet engine that propels it at sustained subsonic speeds. After launch, the missile's folded wings, tail surfaces, and engine inlet deploy. The AGM 86B is then able to fly complicated routes to a target utilizing a terrain contour-matching guidance system. During flight, this system compares surface characteristics with stored maps of the flight route in on-board computers to ascertain the missile's location and guides the missile to the target with pinpoint accuracy. AGM-86B missiles can be air-launched in large numbers by the bomber force. B-52H bombers carry six AGM-86B missiles on each of two externally mounted pylons and eight internally on a rotary launcher, giving the B-52H a maximum capacity of 20 missiles per aircraft. An enemy force would have to counterattack each of the missiles, making defense against them costly and complicated. The enemy's defenses are further hampered by the missiles' small size and low-altitude flight capability, which makes them difficult to detect on radar.

Limitation:

Performance

Category(ies)	Data
Accuracy	See Classified Annex
Dimensions	Length: 249 inches Diameter: 25 inches
Guidance	Inertial Navigation
Launch Platform(s)	B-52H
Propulsion	F112-WR-100
Range	1305 NM
Speed	Cruise, 477 knots
Warhead	W-80
Weight	2850 lbs

System: Common Aero Vehicle (CAV)



Category: Munitions
Function(s):
- Counterair
- Counterland
- Countersea
- Strategic Attack

Long Description: The Common Aero Vehicle (CAV) is an advanced space delivery vehicle capable of delivering and dispensing conventional payloads worldwide from and through space. The CAV is deployed as a prompt response, precision accuracy weapon system to engage the enemy anytime and anyplace without advanced deployment or overflight authorization. Prompt response permits action in the initial phases of conflict to strike high valued, time critical, or heavily defended targets in advance of or complementing expeditionary forces.

The CAV provides environmental protection to munitions or other systems and positions them for release over the target area following re-entry and deceleration to the appropriate release conditions. CAV will employ a combined jam-resistant GPS/INS guidance system that will accurately position the CAV to effectively dispense its payload. CAV's speed and maneuverability combine to make defense extremely difficultt. Planned payloads include Small Diameter Bombs (SDB), Umnanned Aero Vehicles (UAV), Wide Area Search Autonomous Attack Miniature Munitions (WASAAM), and a unitary penetrator.

Precision accuracy and an array of conventional payloads allow the CAV to effectively attack soft and hardened fixed targets, hard and deeply buried facilities, and mobile targets along with the capability to penetrate heavy defenses and limit collateral damage. CAV can also support area surveillance, SEAD, and anti-personnel missions with apporpriate payloads.

CAV is employed by a sub-orbital ballistic trajectory, which does not achieve orbit but follows a ballistic trajectory. Two launch options are proposed: 1) Ground launched from an expendable booster and 2) from the Space Operations Vehicle (SOV). Possible ground launch bases include both East and West coast legions (Cape Canaveral and Vandenburg) from which near global coverage can be achieved. SOVs operating out of CONUS bases using a pop-up maneuver and "kick-motor," as required, could deliver CAVs to any target within minutes.

Attributes of the CAV include:
- US territory based
- Rapid targeting capability
- Maneuverable to provide precise target approach (azimuth, angle and speed of attack)
- Variety of payloads
- Worldwide coverage
- Minimizes overflight constraints
- Minimizes anti-access threats

Limitation:

Performance

Category(ies)	Data
Dimensions	10-12 feet length x 3-4 feet width (nominal)
Other	ACCURACY: 3 - 5 meters CEP for munitions Unitary Penetration Capability: >40 feet of 4000psi steel reinforced concrete, assuming impact velocity of Mach 4. Sortie Rate: Expendable Ground Launched Vehicle: one CAV/sortie with 12 hour turn time ALS: One to six CAV/sortie with 12 hour turn time SOV launched: 6-10 CAVs depending on launch azimuth (10 E, 8 N/S, 6 W)
Payload	(4) SDB; (6) WASAAM; (3) UAVs, or (1) unitary penetrator
Range	DOWNRANGE: ~8000 nm following release at Mach 20-24 + and high altitude (largely dependent on launch paltform insertion capabilities) CROSSRANGE: Depending on specific vehicle design ~800 nm (conical) to 3000 nm (Hypersonic High L/D) RANGE INDICATOR: Range permits rapid strikes from orbiting space platforms that may not be directly over the target area.
Weight	500-800 lbs typical payload and maximum weight of 1000 lbs

System: Minuteman III (LGM-30G)

Category: Munitions
Function(s):
Counterland
Strategic Attack

Long Description: The LGM-30 Minuteman III intercontinental ballistic missile is a key element of the nation's strategic deterrent forces. It is a silo-launched, surface attack guided missile. Minuteman III missiles are dispersed in hardened silos to protect against attack and connected to an underground launch control center through a system of hardened cables. The MMIII has been continually upgraded to retain and improve reliability and performance. Recent improvements include an improved guidance system, solid-propellant rocket motor refurbishment, updated survivable communications equipment, and a new command and control system to enhance immediate communications.

Launch crews, consisting of two officers, are on around-the-clock alert in the launch control center. A variety of communication systems provide the National Command Authorities with highly reliable, virtually instantaneous direct contact with each launch crew. Should command capability be lost between the launch control center and remote missile launch facilities, specially configured airborne launch control center aircraft automatically assume command and control of the isolated missile or missiles. Fully qualified airborne missile combat crews aboard airborne launch control center aircraft would execute the NCA orders should such a contingency arise.

The Minuteman weapon system was conceived in the late 1950s and deployed in the early 1960s. Both the missile and basing components incorporated significant advances beyond the relatively slow-reacting, liquid-fueled, intercontinental ballistic missiles of the previous generation. From the beginning, Minuteman missiles have provided a quick-reacting, inertially guided, highly survivable component to America's nuclear Triad. Minuteman's maintenance concept capitalizes on high reliability and a "remove and replace" approach to achieve a near 100 percent alert rate. Modernization programs have resulted in new versions of the missile, expanded targeting options, significantly improved accuracy and survivability.

Limitation: - Susceptible to anti-ballistic missiles and jamming

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Performance

Category(ies)	Data
Dimensions	LENGTH: 59.9 ft (18.2 m)
Propulsion	Three solid-propellant rocket motors (Thiokol, Aerojet General and United Technologies)
Range	5,218 nm (9,656 km) CEILING: 700 miles (1,126 km)
Speed	13,034 knots (Mach 20+) at burnout
Warhead	Up to three RVs
Weight	79,432 lbs (36,030 kg)

System: AGM-130 Powered Standoff Weapon

Category: Munitions
Function(s):
Counterland

Long Description: The Adverse Weather AGM-130 provides the warfighter with advanced combat capabilities for superior effectiveness. These capabilities include 24-hour, all weather, combat capability with a new INS/GPS Navigation System coupled with a state-of-the-art charge-coupled device TV and imaging focal plane array IR seekers. Derived from the GBU-15, it has since been extensively modified to an advanced, precision-guided weapon used against high value fixed targets. It features INS/GPS man-in-the-loop capabilities and has a propulsion section enabling enhanced standoff capability. There are two versions of the weapon; the AGM-130A model uses the MK-84 warhead and the AGM-130C model uses the BLU-109 penetration warhead. Both versions have advanced control sections and new Switchable Data Links (SDL) for horizontal target attack profiles. There are two improved guidance sections for day and night extended capability: Television Guidance Section (TVGS) and Improved Modular Infrared Sensor (IMIRS).

Limitation:

Performance

Category(ies)	Data
Dimensions	Length: 158.8 inches Diameter: MK-84 Warhead 18.0 in BLU-109 Warhead 16.0 in Rocket Motor 9.0 in Guidance Section 15.0 in Control Section 16.0 in Tail Section (Wings) 59.0 in
Guidance	GPS/INS System/Precise Adverse Weather, day or night Television Guidance Section (TVGS) & Improved Modular Infrared Sensor (IMIRS)
Launch Platform(s)	F-15E
Propulsion	Solid Propellant Rocket Motor
Warhead	MK-84 or BLU-109 (adapter kit required)

Weight	AGM-130A-11 (MK-84, TV): 2978 lbs AGM-130A-12 (MK-84, IR): 3001 lbs AGM-130C-11 (BLU-109, TV): 3064 lbs AGM-130C-12 (BLU-109, IR): 3087 lbs

System: AGM- 65 Maverick

Category: Munitions
Function(s):
Counterland

Long Description: The AGM-65 Maverick is a tactical, air-to-ground lock-on before launch guided missile designed for close air support, interdiction and air-defense supression. The Maverick provides stand-off capability and high probability of strike against a wide range of tactical targets, to include armor, air defenses, ships, transportation equipment, and fuel storage facilities. Different combinations of guidance packages and warheads can be attached to the rocket motor section to produce a different weapon. The Maverick has three different seekers and two different warheads. The solid-rocket motor propulsion section is common to all variants. The seeker options are electro-optical (EO) imaging, imaging infrared (IR), or a laser guidance package (currently USN only). The warhead is in the missile's center section. Either a 125-lbs shaped-charge warhead or a 300-lbs penetrator warhead can be used. A contact fuse in the nose fires the shaped-charge warhead. The penetrator uses a delayed fuse, allowing the warhead to penetrate the target with its kinetic energy before firing. The latter is very effective against large, hard targets. The D model is used against tanks and the G model is designed to attack buildings. A-10, F-15E, F-16, and JSF aircraft are fitted to carry the Maverick. As many as six missiles can be carried by an aircraft, typically four due to excessive drag, usually in three round, underwing clusters, allowing the pilot to engage several targets on one mission. The missile also has "launch-and-leave" capability that enables a pilot to fire it and immediately take evasive action or attack another target as the missile guides itself to the target. Mavericks can be launched from high altitudes to tree-top level and can hit targets ranging from a distance of a few thousand feet to 13 nm at medium altitude. Engagement usually begins at 5-6 miles and finishes as close as one or two miles.

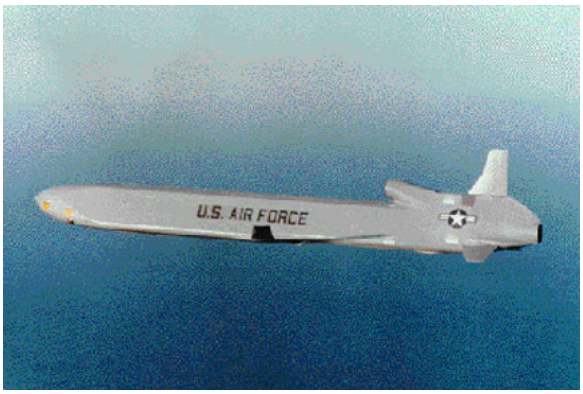
Limitation:

Performance

Category(ies)	Data
Accuracy	< 2 m
Dimensions	Length: 98 inches Diamter: 12 inches
Guidance	TV (A,B,H,K); IR (D, F, G2); Laser (E) - USN Only
Launch Platform(s)	A-10A, F-15E, F-16A-D

Propulsion	Single Stage Solid Rocket
Range	6.5 NM
Speed	Supersonic
Warhead	A,B,D,H - 125 lbs shaped charge jet and blast E, F, G, K - 300 lbs Penetrator / Blast-Fragmentation
Weight	485 lbs

System: AGM- 86C/D Conventional Air-Launched Cruise Missile (CALCM)



Category: Munitions
Function(s):
- Counterair
- Counterland
- Countersea
- Strategic Attack

Long Description: Small, winged conventional air-launched cruise missile powered by a turbofan jet engine that propels it at sustained subsonic speeds. After launch, missile's folded wings, tail surfaces and engine inlet deploy. It is then able to fly complicated routes to the target with use of terrain contour-matching (TERCOM) guidance system. During flight, this system compares surface characteristics with maps of planned flight route stored in on-board computers to determine its location. As AGM-86C nears target, comparisons become more specific, guiding the missile to target with accuracy up to 15 meters. The CALCM can be launched by B-2s. Defense against the AGM-86C is costly as enemy force would have to counterattack each of the missiles. Such efforts are further hampered by their small size and ability to travel low to the ground which makes them difficult to detect on radar. The launching platform uses GPS/INS guidance systems.

Limitation: - Platform requires 10,000 ft runway

Performance

Category(ies)	Data
Accuracy	See Classified Annex
Dimensions	Length: 20 ft 9 in
	Diameter: 25 inches
Guidance	Inertial Navigation integrated with GPS
Other	B-52H
Propulsion	F107-WR-100
Range	Nominal: 600 NM
	Specific: See Classified Annex
Speed	Nominal: High Subsonic
	Specific: See Classified Annex
Warhead	2000 lb class blast fragmentation
Weight	3250 lbs

System: AGM- 88 High-Speed Antiradiation Missile (HARM)

Category: Munitions
Function(s):
- Counterair
- Counterland
- Countersea

Long Description: The AGM-88 High Speed Antiradiation Missile (HARM) can detect and attack radar-emitting targets. The proportional guidance system that homes in on enemy radar emissions has a fixed antenna and seeker head in the missile nose. A smokeless, solid-propellant, dual-thrust rocket motor propels the missile.

Limitation:

Performance

Category(ies)	Data
Accuracy	See Classified Annex
Dimensions	Length: 164 inches Diameter: 10 inches
Guidance	Anti-Radiation
Launch Platform(s)	F-16C/D
Propulsion	Boost Sustain 64,000 lbs/sec, Low Smoke
Range	26 NM
Speed	Mach 3.5
Warhead	B: WAU-7 143.5 lbs Direct Fragmentation C: WAU-27/B
Weight	795 lbs.

System: AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM)

Category: Munitions
Function(s):
Counterair

Long Description: The AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM) is a new generation air-to-air missile. It has all-weather, beyond-visual-range capability. The AMRAAM program improves the aerial combat capabilities of U.S. and allied aircraft to counter current and future enemy air-to-air weapons. AMRAAM is a follow-on to the AIM-7 Sparrow missile series. The missile is faster, smaller, lighter and has improved capabilities against low-altitude targets. It incorporates an active radar with an inertial reference unit and micro-computer system, which makes the missile less dependent upon the fire-control system of the aircraft. Once the missile closes on a target, its active radar guides it to intercept. This enables the pilot to aim and fire several missiles simultaneously at multiple targets. The pilot can then perform evasive maneuvers while the missiles guide themselves to their targets.

Limitation:

Performance

Category(ies)	Data
Accuracy	See Classified Annex
Dimensions	Length: 144 inches Diameter: 7 inches
Guidance	Inertial/Command Inertial and Active RADAR
Launch Platform(s)	F-15A-E, F-16C/D, F18C-F, F/A-22, F-35
Propulsion	Boost/Sustain, Reduced Smoke
Range	17 NM
Speed	Supersonic
Warhead	45 lbs Blast/Fragmentation
Weight	345 lbs

System: CBU-107 Passive Attack Weapon (PAW)

Category: Munitions
Function(s):
Counterland

Long Description: The CBU-107 Passive Attack Weapon (PAW) is a modified Wind-Corrected Munitions Dispenser (WCMD) packed with 3,700 non-explosive penetrator rods designed to strike unshielded targets where explosive fills are unnecessary or undesirable. After the PAW is dropped from an aircraft, the weapon's outer skin separates at a preset altitude, allowing the individual penetrator rods to free fall to the earth and penetrate the target. With this munition, there is no explosive warhead and minimal collateral damage. Attractive options include chemical and biological targets, which an explosive weapon would jettison into the atmosphere, and 'soft? structures in populated areas where the potential for collateral damage is high. The WCMD kit has an upgraded Inertial Navigation Unit, reducing the weapon's destructive radius to less than 30 feet.

Limitation:

Performance

Category(ies)	Data
Armament/Payload	350 x 15in rods, 1,000 x 7in rods, and 2,400 2in rods
Dimensions	Length: 92 inches
Guidance	WCMD INS Mid-course
Weight	1000 lbs

System: Cluster Bomb Units (CBU)

Category: Munitions
Function(s):
Counterland

Long Description: Cluster Bomb Units (CBUs) are primarily fragmentation weapons. CBUs, like GP bombs, can feature mix and match components (submunitions, fuzes, etc.) to produce the desired effect.

The 103, 104, 105, and 107 models have Wind Corrected Munition Dispensor (WCMD) kits, an intertial guidance kit which improves delivery accuracy by correcting for wind. The WCMD tail kit inertially steers the munition from a known release point to the target coordinates while compensating for launch, transients, winds aloft, surface winds and adverse weather.

CBU-87/103: The CBU-87 is a 1,000-pound, Combined Effects Munition (CEM) for attacking soft target areas with detonating bomblets. The CBU-87 CEM, an all-purpose, air-delivered cluster weapons system, consists of a SW-65 Tactical Munitions Dispenser (TMD) with an optional FZU-39 proximity sensor. The BLU-97/B Combined Effects Bomb (CEB), effective against armor, personnel and material, contains a shaped charge, scored steel casing and zirconium ring for anti-armor, fragmentation and incendiary capability. The bomblet case is made of scored steel designed to break into approximately 300 preformed ingrain fragments for defeating light armor and personnel. A total of 202 of these bomblets are loaded in each dispenser enabling a single payload attack against a variety and wide area coverage. The footprint for the CBU-87 is approximately 200 meters by 400 meters.

CBU-89/104 Gator Mine: The CBU-89 Gator Mine, a 1,000-pound cluster munition containing antitank and antipersonnel mines, consists of a SUU-64 Tactical Munitions Dispenser with 72 antitank mines, 22 antipersonnel mines, and an optional FZU-39 proximity sensor. The antitank mine is a magnetic sensing submunition effective against tanks and armored vehicles. The antipersonnel mine has a fragmenting case warhead triggered by trip wires. The mines are armed when the dispenser is opened, and detonation is initiated by target detection, mine disturbance, low battery voltage, and a self-destruct time-out.

CBU-97/CBU -105 Sensor Fused Weapon (SFW): See Toolbox entry

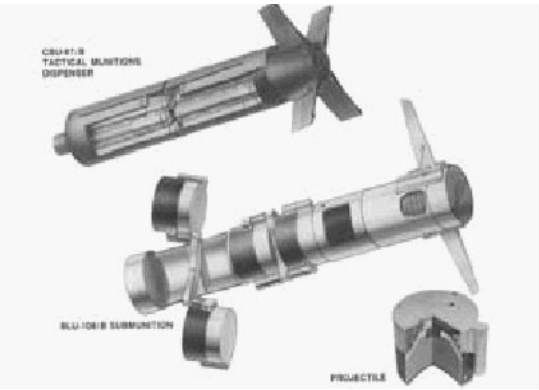
CBU-107 Passive Attack Weapon (PAW): The PAW is a modified Wind Corrected Munition Dispensor packed with over 3,700 non-explosive penetrator rods designed to strike unshielded soft targets where explosives are unnecessary or undesireable. After the PAW is dropped from an aircraft, the weapon's dispenser canister separates at a preset altitude, allowing the individual penetrator rods to free fall to the earth and penetrate the target. With this munition, there is no explosive warhead and there is minimal collateral damage. Attractive options include chemical weapons and "soft" structures in populated areas where the potential for collateral damage is high. The WCMD kit has an upgraded Inertial Navigation Unit, reducing the weapon's destructive radius to less than 30 feet.

Limitation:

Performance

Category(ies)	Data
Accuracy	1,200,000 feet squared area coverage
Dimensions	LENGTH: average 92 in DIAMETER: average 16 in
Guidance	WCMD
Launch Platform(s)	87: A-10A; B-52H; F-15E; F-16 A-D; F-117A; B2 89: A-10A; B-52H; F-15E; F-16 A-D; F-117A; B2 107: B-52H; F-16A-D; F-15E
Propulsion	NA
Range	Direct Attack, depends on release altitude and velocity
Warhead	87/103: 202 eachCEB-BLU-97/B AP/AM Shaped Charge/Fragmentation/Incendiary 89/104: 72 each BLU-91/B Antitank Bomblets (4 lbs each) 22 each BLU/92B Bomblets Antipersonnel Bomblets 3.75 lbs each 107: 350 x 15in rods, 1,000 x 7in rods, and 2,400 2in rods
Weight	87/103: 950 lbs 89/104: 705 lbs 107: approx 1,000 lbs

System: Cluster Bomb Units (CBU-97/CBU-105) Sensor Fused Weapon (SFW)



Category: Munitions
Function(s):
- Counterland
- Countersea

Long Description: The CBU-97/CBU 105 Sensor Fused Weapon (SFW) is an anti-armor cluster munition that is employed by fighter/attack and bomber aircraft to provide multiple kills per pass against armored and support vehicle combat formations and to cut enemy lines of control. The SFW is employed for precision strike/deep attack/interdiction (e.g., against reinforcements) operations beyond the FEBA. The ASCM, in conjunction with ISR and BM/C2 assets, strengthens the effective architecture for dealing with Hider/Finder problem (e.g. Scuds).

The CBU-105 SFW is fitted with a Wind Corrected Munition Dispenser (WCMD), an inertial guidance kit that is attached to the SFW to improve delivery accuracy when released from medium to high altitude. The other primary components of this 1,000 lbs class weapon are the 10 BLU-108/B submunitions and 40 "hockey puck" shaped skeet infrared sensing projectiles. After release, the WCMD opens and dispenses the ten submunitions which are parachute stabilized. At a preset altitude sensed by a radar altimeter, a rocket motor fires to spin the submunition and initiate an ascent. The submunition then releases its four projectiles, which are lofted over the target area. The projectile's sensor detects a vehicle's infrared signature, and an explosively formed penetrator fires at the heat source. If no target is detected, the warhead detonates after a preset time interval.

Limitation:
- Targets can position themselves outside of the footprint (e.g. spread out to minimize effect)
- Lacks sufficient discrimination capabilities for use in the close battle environment
- Susceptible to jamming
- Weapons effectiveness decreases as release altitude, dive angle, and/or time of flight increases due to adverse effects of wind conditions, weapon dispersion, and aim point uncertainties on delivery accuracy. (WCMD and P3I programs are intended to address current performance shortfalls in SFW)

Performance

Category(ies)	Data

Accuracy	See Classified Annex
Dimensions	Length: 92 inches Diameter: 15.6 inches
Guidance	105: WCMD INS
Launch Platform(s)	F-16 A-D; F-15E; A-10; B-1; B-2; B-52
Propulsion	dual nozzle rocket motor in each submunition
Range	50 -100 NM
Warhead	BLU-108
Weight	97: 920 lbs 105: 934 lbs

System: GBU-39/B Small Diameter Bomb (SDB)

Category: Munitions
Function(s):
Counterland

Long Description: The GBU-39/B Small Diameter Bomb (SDB) is a light-weight bomb utilizing high density suspension equipment which allows a 4 to 1 increase in independently targetable weapons. It has a high density carriage, virtual interface, and is compatible with fleet internal and external storage stations. It has a low-observable and low-drag external carriage and can conduct incremental or salvo employment.

The Small Diameter Bomb has an Advanced Anti-Jam Global Positioning System aided Inertial Navigation System (AJGPS/INS) to provide guidance to the coordinates of a stationary target. An SDB accuracy support system provides data to the weapon using existing communications links to improve circular error probable. The payload is a very effective multipurpose penetrating and blast fragmentation warhead coupled with a cockpit selectable electronic fuze.

Limitation: - Susceptible to jamming.

Performance

Category(ies)	Data
Accuracy	12 ft CEP
Armament/Payload	Platform, Carriages, SDBs F-15E, 5, 20 F/A-22, 2, 8 F-35, 6, 24 F-16, 2, 8 F-117, 2, 8 A-10, 4, 16 B-1, 24, 96 B-2, 16, 64 B-52, 12, 48 UCAV, 2, 8 MQ-9, 2, 8
Dimensions	System (Carriage + GBU 39/B): Weight: 1460 lbs

	Length: 143 inches Width: 16 inches
	GBU 39/B: Weight: 285 lbs Length: 71 inches Width: 7.5 inches
Guidance	Precision Augmented INS/GPS; Anti-jam GPS with SAASM
Launch Platform(s)	All manned and unmanned strike platforms
Range	>60nm
Speed	Glide
Warhead	Multipurpose; penetrates >3 ft steel reinforced concrete Insensitive Munition

System: General Purpose Munitions

Category: Munitions
Function(s):
- Counterland
- Countersea

Long Description: General Purpose Munitions are warheads that rely on blast and fragmentation to cause damage. These munitions provide the bodies for guidance units such as laser-guided and Joint Direct Attack Munitions (JDAM) kits. A blast warhead is one that is designed to achieve target damage primarily from blast effect. When a high explosive detonates, it is converted almost instantly into a gas at very high pressure and temperature. Under the pressure of the gases thus generated, the weapon case expands and breaks into fragments. The air surrounding the casing is compressed and a shock (blast) wave is transmitted into it. Typical initial values for a high-explosive weapon are 200 kilobars of pressure (1 bar = 1 atmosphere) and 5,000 degrees Celsius.

Most aircraft can carry these munitions. The following warheads are in the U.S. inventory:
Mk-82: 500 lbs
Mk-83: 1,000 lbs
Mk-84: 2,000 lbs
BLU-82: 15,000 lbs (Can only be dropped by MC-130)
M-117: 750 lbs. Demolition bomb, delivered typically by the B-52

The Mk-62 is an open water or port access sea mine which can be delivered by the B-2 (80), the B-1 (84), and the B-52 (51).

Limitation:
- Without guidance systems limited to dropping, dive-bombing and lofting by aircraft
- Some munitions not effective in penetrating hardened shelters

Performance

Category(ies)	Data

System: Guided Bomb Units (GBUs) - Electro-Optical/Infrared

Category: Munitions
Function(s):
Counterland

Long Description: The GBU-15 is an unpowered, glide weapon used to destroy high value enemy targets. It is designed for use by an F-15E aircraft. This weapon provides the capability for accurate (automatic or manual) guided delivery of a MK-84/BLU-109 bomb body at increased ranges. The GBU-15's effective standoff range is greater than that of a laser-guided munition, since the GBU-15 does not need to have acquired the target before it is released. The weapon is remotely controlled through a datalink system by a Weapon Systems Operator (WSO). The WSO locates the target area and the specific aimpoint by observing the video transmitted from the weapon. Weapon video is either electro-optical (TV camera) or infrared, and generated by a sensor in the nose of the weapon. The GBU-15 is normally deloyed in the indirect mode where a weapon is launched towards the target without lock on. The GBU 15 can be used in the buddy mode where an A/C launches the weapon and the other A/C performs the control functions. The original Long Cord Wing (LCW) or the newer Short Cord Wing (SCW) are used to stabalize the weapon system.

The EGBU-15 (Enhanced Guided Bomb Unit-15) is a modification to the GBU-15 providing an adverse weather capability by adding GPS/INS guidance. The EGBU-15 is fitted with a GPS Aided Inertial Navigation System (GAINS), which allows for an autonomous launch option while still retaining man-in-the-loop capability.

Limitation:

Performance

Category(ies)	Data		
Dimensions	Length: 12.8ft Body Diameter: 1.5ft Wingspan: 4.9ft		
Guidance	Designation	Guidance System	Munition
	GBU-15/ 31B:	Electro Optical TV	BLU-109
	EGBU-15/ 31A/B	TV, GPS/INS	BLU-109
	GBU-15/ 32B	Imaging IR	BLU-109

	EGBU-15/ 32A/B	IR, GPS/INS	BLU-109
	GBU-15/ 1C/B	Electro Optical TV	MK-84
	EGBU-15/ 1B	TV, GPS/INS	MK-84
	GBU-15/ 2C/B	Imaging IR	MK-84
	EGBU-15/ 2B	IR, GPS/INS	MK-84
Weight	2,500lbs		

System: Guided Bomb Units (GBUs) - Joint Direct Attack Munition (JDAM)

Category: Munitions
Function(s):
Counterland

Long Description: JDAM is a GPS/navigation system munition. It has adverse weather capability, enables air-to-ground strikes, and allows for continuous 24-hour operations. The JDAM provides a low-cost GPS-aided INS kit for the Air Force inventory of Mk-84 and BLU-109 2,000 lbs and Mk-83 1,000 lbs bombs that can be used to strike fixed and relocatable targets. JDAM provides an accurate (within 13-30 m) capability for virtually the entire Air Force bomber and fighter force. JDAM increases the number of targets that can be hit per sortie (16 individual targets for the B-2; 24 for the B-1).

Diamond Back is a high-performance wing kit designed to extend the range of free-fall and boosted guided weapons. The unique joined-wing configuration provides a mechanically robust, high-aspect ratio wing that is deployed from a small package, maximizing aerodynamic performance as well as fighter and bomber internal and external loadouts. The Diamond Back requires no additional propulsion and expands the JDAM footprint significantly.

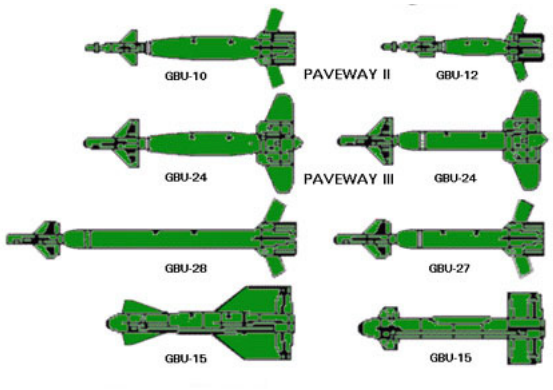
Limitation:
- Adverse capabilities in poor weather
- Susceptible to GPS jamming

Performance

Category(ies)	Data
Accuracy	13 m CEP, Adv Weather GPS 30 m with INS
Dimensions	Length: 11.5 - 13 feet Diameter: GBU-31: 150 inches GBU-32: 120 inches
Guidance	GUIDANCE: INS/GPS CONTROL: Tail aerodynamic AUTOPILOT: Proportional Guidance
Launch Platform(s)	B-1B (24); B-2 (16); B-52H (12); F-15E (5); F-16 C/D (2); F/A-22 (only GBU 32 or 38); F-35 Navy: F-14D (4); F/A-18 C/D (4); S-3 (2), P-3 (9);

Range	Depends on release altitude and velocity
Speed	Cruise
Warhead	Mk-84/BLU-117 or BLU-109
Weight	2039 lbs Mk-84; 2118 lbs BLU109; 2059 lbs Navy BLU-117;

System: Guided Bomb Units (GBUs) - Laser



Category: Munitions
Function(s):
Counterland

Long Description: Laser Guided Bomb Units (LGBUs) are general pupose bombs with attached laser guidance kits. The kits consist of a computer-control group (CCG), guidance canards attached to the front of the warhead to provide steering commands, and a wing assembly attached to the aft to provide lift. LGBUs are maneuverable, free-fall weapons requiring no electronic interconnectivity to the delivery aircraft. They have an internal semiactive guidance system that detects laser energy and guides the weapon to a target illuminated by an external laser source. The designator can be located in the delivery aircraft, another aircraft, or a ground source.

Three generations of Paveway LGBU technology exist, with each successive generation representing a change or modification in the guidance mechanism. Paveway I was a series of laser guided bombs with fixed wings. Paveway II (with retractable wings) and Paveway III are the Air Force designations for 500- and 2,000-pound-class LGBUs. A guidance control unit is attached to the front of the bomb, and a wing assembly is attached on the rear. Both generations are compatible with current Army and Navy designators. Paveway II and III have preflight selectable coding. Paveway III is the third-generation LGBU, commonly called the low-level laser-guided bomb (LLLGB). It is designed to be used under relatively low ceilings, from low altitude, and at long standoff ranges. The Paveway III generation provides optimum operational flexibility through the use of an adaptive digital autopilot, large field-of-regard, and a highly sensitive seeker. Paveway II includes: GBU-10, GBU-12, & GBU-16. Paveway III includes: GBU-24, GBU-27, & GBU-28.

Limitation:

Performance

Category(ies)	Data			
Dimensions	DESIGNATION	LENGTH	DIAMETER	WT
	GBU-10 D/B	14.1ft	1.5ft	1985
	GBU-12 C/B	10.9ft	1.5ft	603
	GBU-24	172.76in	18in	2257
	GBU-27	166in	14.5in	2185

	GBU-28	229in	14.5in	4576
Guidance	GBU-10 D/B: KMU-351 E/B GBU-12 C/B: KMU-388 C/B GBU-24: WGU-12B/B, 39A/B,43/B GBU-27/B: WGU-25B/B or 39A/B GBU-28 A/B: WGU-36A/B			
Launch Platform(s)	GBU-10: A-10, B-52, F-15E, F-16, F-117 GBU-12: A-10, B-52, F-15E, F-16, F-117 GBU-24: F-16, F-15E GBU-27: F-117 GBU-28: F-15E			
Warhead	GBU-10 D/B: MK 84 GBU-12 C/B: MK 82 SNAKEYE GBU-24/B: MK 84 GBU-24 A/B: BLU-109 GBU-27/B: BLU-109 GBU-28A/B: BLU-113			

System: Thermobaric & Hyperbaric Munitions

Category: Munitions
Function(s):
Counterland

Long Description: Hyperbaric munitions were the first class of this type of weapons. The first hyperbarics ("hyper"' meaning extreme, "barics" meaning pressure) weapons were fuel air explosives. They are basically modified chemical warfare munitions that replace the chemical warfare agents with a "fuel" (e.g. diesel fuel, etc.). They contain a small explosive "burster charge" core that, when detonated, disperse the fuel over a large area to produce a large fuel-air volume of space. A secondary explosive in the munition is then detonated, resulting in a large blast area with significant blast overpressures. They are effective against area surface targets for clearing mine fields.

The newer thermobaric ("thermo" meaning temperature, "baric" meaning pressure) munitions operate much the same way as hyperbaric munitions except that the dispersed fuel (now solid chemicals) also contains incendiaries such as finely powdered aluminum which burns at >2800 degrees F. With thermobarics, the temperatures in the fuel-air mix explosion are much higher than with hyperbaric munitions, producing significantly enhanced effects (much higher temperatures and blast overpressures). These munitions are designed to be used against hard and/or deeply buried targets. They penetrate the thin layer of rock above tunnel portals or through exterior doors and detonate within the targeted complexes. The combination of greater heat and higher overpressures are devastating within enclosed facilities.

The BLU-82, also called the Daisy Cutter or Big Blue, is an unguided bomb weighing 15,000 lbs that is the approximate size of a small car and can only be delivered by the MC-130 Combat Talon special operations transport. Big Blue sits on a pallet that is rolled out of the back of the Combat Talon over the target. A parachute slows the fall of the weapon to the earth, giving the plane sufficient time to get out of range. A 38-inch probe extending out of the nose hits the ground first and detonates the weapon above ground level. The detonation of Big Blue provides an explosive overpressure of greater than 1,000 lbs/square inch and heat upwards of 10,000 degrees Fahrenheit. The pressure sears anything within the area of approximately 1,000 yards. The effective kill zone range is 200 feet and eardrums and lungs will be ruptured up to 500 feet away.

The Massive Ordinance Air Blast (MOAB) weapon weighs 21,500 lbs, including a satellite guidance system intended to bring the bomb closer to its target than its predecessor, the BLU-82, which falls to the earth unguided. It is guided to the target either by GPS

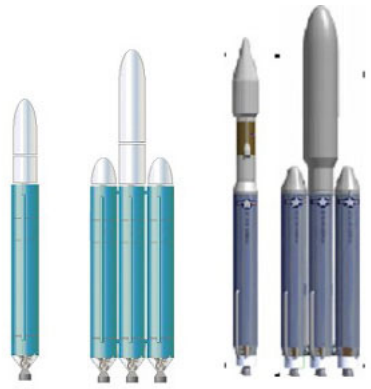
Satellites or, if those fail, by inertial gyroscopes. This means the pilot can drop it from far above the range of any air-defense radar. The MOAB also has wings; they allow the unpowered bomb to glide toward the target from a distance of at least a few miles, providing the pilot an additional measure of safety. The MOAB is carried aloft aboard an MC-130 where it rolls out of the rear cargo door of the plane on a pallet, and a parachute yanks it free of the aircraft. The pallet and parachute then separate from the bomb.

Limitation:
- Requires large transport aircraft
- The BLU-82 lacks precision

Performance

Category(ies)	Data
Dimensions	BLU-82: Weight: 15,000 lbs. Explosive Wt: 12,600 lbs. of the less powerful GSX explosives (ammonium nitrate, aluminum powder and polystyrene) Length: 141.6 in. Diameter: 54 in. Fuze: M904 (Nose), M905 (Tail) Deployed: MC-130 cargo aircraft MOAB: Weight: 21,000 lb Explosive Wt: 18,000 lb Length: 30 ft Diameter: 40.5 in Guidance: Will use the EGBU-15A Navigation Electronics (GPS Aided Inertial Navigation System (INS)- [GAINS]) Deployed: MC-130 cargo aircraft

System: Evolved Expendable Launch Vehicle (EELV): Heavy and Medium



Category: Space Lift and Space Control
Function(s):
Spacelift

Long Description: The Air Force has available two families of reliable, affordable, expendable launch vehicles which fulfill medium and heavy spacelift missions. These spacelift assets provide a spacelift design and an operational process that is supportable, maintainable and able to meet spacelift schedule demands. In addition, these spacelift assets have standardized launch and payload interfaces. They are designed for missions of 8,500 lbs - Geosynchronous Transfer Orbit (GTO) to 13,500 lbs - Geosynchronous Orbit (GEO). These spacelift assets will cut the cost of launches by 25% to 50%, compared to their predecessors (Titan, Atlas II, and Delta II and III).

The space lift system has the capacity to launch a medium load within 8 days of previous launch and 26 days for a heavy load. The Space Lifter can operate during normal weather conditions allowable by range safety and the Launch Weather Officer.

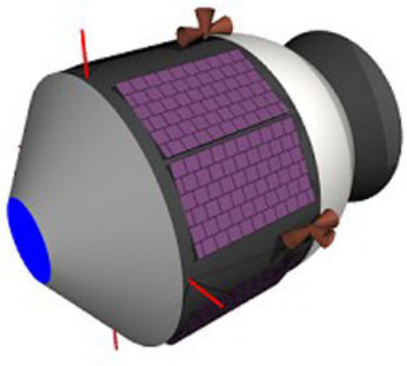
Each EELV launch pad is capable of launching all configurations in its family. Streamlined operations using off pad processing and automated checkout significantly reduces time and costs associated with launch operations. The EELV provides lift for a variety of satellites, including MILSTAR, NPOESS, DSCS, GPS II, GPS III, DMSP and DSP.

Limitation:
- Constrained to appropriate launch windows
- Unable to deliver a load of more than 45,000 lbs
- Limited by launch operations process (45-90 days required to launch from call-up; only 26 launches per year possible).
- Can only be operated out of bases containing Space Lift launch infrastructure. The one launch pad at Vandenberg AFB and the two launch pads at Cape Canaveral are unique to each contractor's design.

Performance

Category(ies)	Data
Payload	Medium = 8,500 lbs (3,856 kg) to GTO; Heavy = 29,000 lbs to GTO
Turn Around Rate	Heavy= 26 days from prior launch; Medium= 8 days from prior launch

System: Microsats



Category: Space Lift and Space Control
Function(s):
- C4ISR
- Counterspace

Long Description: Microsats are small, expendable satellites with a short on-orbit life (measured in months, rather than years). Microsats are usually put into space via Air Launch systems, but may also be launched by a Space Operations Vehicle (SOV), a Reuseable Launch Vehicle (RLV) or an Evolved Expendable Launch Vehicle (EELV). Once in orbit, the satellites are deployed and begin autonomous operations. Microsats can be used to establish space control, while also providing surge capability of space assets for ISR and space-denial operations. Microsats can be configured to carry six different types of payloads:

1. Microsat Space Surveillance Payload: EO/IR and Optical sensors may be used to image and identify both allied and adversary space systems.

2. Microsat Satellite Jammer/Dazzler Payload: This payload is a radio frequency transmitter and associated parabolic dish antenna with a 30-inch diameter. This system is capable of jamming satellite uplinks or downlinks, or dazzling satellite sensors without destroying the subject satellite.

3. Microsat Directed Energy Payload: This payload uses either a high-power microwave (HPM) system or an ultra-wide-band (UWB) system to disable or destroy adversary space systems. HPM weapons fire a narrow and powerful beam of high-frequency radiation which can pierce a satellite's armour and fry its circuitry. The UWB beam is more of a scattergun weapon, with a broad beam and wide frequency range designed to knock out any electronic equipment in the vicinity. At close range, they could permanently cripple a satellite's circuitry, while at greater distances their power may only be enough to temporarily disrupt circuits.

4. Microsat Satellite Docking Payload (Docker): This microsat is a grappling fixture that allows the Docker to secure itself to another satellite, thereby taking altitude control of the subject satellite. Once deployed, the Docker enters into co-orbit with the target satellite, approaches it, and then uses its grapple fixture to attach itself to the target. Using its bus thrusters, the Docker can reposition or re-orient the subject satellite as required. In emergency situations, the Docker can be used to de-orbit satellites to clear orbital positions.

5. Microsat Kinetic Kill Payload (MKKP): This payload is a homing system designed to seek and destroy adversary spacecraft. The MKKP initially receives targeting telemetry from a ground station, then determines its own and the target's location. The MKKP calculates an intercept trajectory once deployed from the SMV, SOV, or EELV, and begins autonomous operations. Once the target is identified, the MKKP accelerates to hypervelocity. A terminal homing system identifies the center of mass of the target spacecraft and the MKKP strikes that point, destroying the target. Real-time imagery data of the intercept is provided through impact for real-time battle damage assessment.

6. Microsat Satellite Blocker Payload (Blocker): This payload is a gimbaled circular array made with a light weight lead substitute on a mylar film. The Blocker deploys like a fan to a full circular configuration with a diameter of 5 meters. This microsat is capable of blocking satellite uplink or downlink on all frequencies depending on proximity to the satellite or antenna, as well as EO/IR sensors, without destroying the subject satellite. The Blocker approaches the target satellite and deploys the blocker fan, blocking the entire satellite or the antenna based upon the size of the subject satellite. The microsat then begins station-keeping, automatically moving with the subject satellite to maintain the blocking position.

Limitation: - Time on orbit

Performance

Category(ies)	Data
Capability	DESIGN LIFE: Up to several months
Orbit	LEO, MEO, GEO
Other	MASS: 121 lbs (55 kg), including bus
	DIMENSIONS: 17" by 30"

System: Orbital Deep Space Imager (ODSI)

PHOTOGRAPH NOT AVAILABLE

Category: Space Lift and Space Control
Function(s):
C4ISR
Counterspace

Long Description: Oribital Deep Space Imager consists of 3 satellites in a highly elliptical orbit for performing deep space imaging. ODSI's primary function is to provide imagery for space object identification (SOI) data of satellites in GEO orbit. These satellites can be deployed using EELV's, SOVs or other spacelift assets, and can be employed with SBL, microsats, SOV, and ground-based ASAT weapons to perform ASAT and space superiority missions. The constellation provides high-resolution flyby imagery of GEO satellites with on-board processing to downlink satellite images to a user. The imager will also provide SOI data on additional targets, as needed, including satellites in other orbits. A space-based imaging system would increase the SOI coverage and capacity of the Space Surveillance Network to provide more timely routine imagery of DS objects with complete coverage of all GEO satellites.

Limitation:
- Susceptible to anti-satellite weapons
- Small number of control centers provide lucrative targets
- Ability to jam the downlink via data relay, microsats, or SOF forces
- Electronic military deception and information attack against the satellite
- Requires a capable launch infrastructure

Performance

Category(ies)	Data
Orbit	HEO

System: AC-130 Gunship

Category: Strike
Function(s):
- Counterland
- Special Operations Employment

Long Description: The AC-130 Gunship is a heavily armed, air-refuelable, four-engine turbo prop gunship that integrates side-firing weapons with sophisticated sensor, navigation and fire control systems to provide surgical firepower or area saturation effects. The AC-130 has limited adverse weather capability but is capable of extended night operations, and is able to loiter in an area and supply "firepower on demand". The AC-130U "Spooky" has greater altitude capability than the AC-130H "Spectre" and combines increased firepower, reliability, and superior accuracy with the latest methods of target location. The two 200 mm canon of the H model are replaced with one trainable 25 mm Gatling gun on the U model. Although the AC-130H Spectre and AC-130U Spooky use different avionics, their fire support is generally comparable.

The AC-130 can slave all weapons to the APQ-180 digital fire-control radar and have all-light-level television. ECM in both the U and H versions are sufficient for low-to-medium threat environments. The gunship utilizes INS/GPS and limited body armor. Radar and electronic sensors enable positive identification of friendly ground forces. This capability is degraded during adverse weather conditions. The AC-130H will be equipped with the Directional Infrared Countermeasures (DIRCM) system. The DIRCM system will work in conjunction with other onboard self-protection systems to enhance the aircraft's survivability against currently deployed infrared guided missiles.

The AC-130s primary missions include: close air support with other aircraft such as the A-10, F-16, F-18, etc.; ground interdiction as part of a package with F-16, F-15E, etc.; perimeter and point defense; convoy, naval, and helicopter escort and vectoring; landing, drop, and extraction zone support; forward air control with the A-10, F-16, etc.; and limited command and control / communications relay. The AC-130 is highly capable of night operations and performs CSAR w/ MH-53J, OA-10 and UAVs.

Limitation: - Vulnerable to air-to-air and surface-to-air missiles.

Performance

Category(ies)	Data

Armament/Payload	One 40 mm Bofors cannon; one Horowitzer H: 2 20mm Vulcan Guns U: 25mm gun
Ceiling	25,000 feet
Crew	Thirteen: pilot, co-pilot, navigator, fire control officer, electronic warfare office, flight engineer, TV operator, infrared detection set operator, loadmaster, and four aerial gunners.
Dimensions	Length: 99 feet Height: 39 feet Wingspan: 133 feet
Max T/O Weight	155,000 pounds
Powerplant	Four Allison T56-A-15 turboprop engines
Range	1500 NM
Speed	Cruise: 251 knots

System: CV-22 Osprey

Category: Special Operations Forces (SOF)
Function(s):
Special Operations Employment

Long Description: The CV-22 Osprey is a tilt-rotor, vertical/short takeoff and landing (VSTOL), multi-mission aircraft. The Osprey's primary mission is to perform low-level, long-range, undetected penetration into denied areas, day or night, in adverse weather, for infiltration, exfiltration, and resupply of special operations forces. Its terrain-following, terrain-avoidance radar and forward-looking infrared sensor, along with a projected map display, enable the crew to follow terrain contours and avoid obstacles, making low-level penetration possible. Active and passive defensive countermeasures increase the survivability of the aircraft.

The tilt rotor design combines the vertical flight capabilities of a helicopter with the speed and range of a turboprop airplane and permits aerial refueling and world-wide self-deployment. The Osprey can rapidly deploy and be mission-ready within minutes at forward locations, and can carry up to 24 combat troops.

The airframe of the CV-22 is constructed primarily of graphite-reinforced epoxy composite material. The composite structure provides improved strength-to-weight ratio, corrosion resistance, and damage tolerance compared to typical metal construction. Battle damage tolerance is built into the aircraft by means of composite construction and redundant and separated flight control, electrical, and hydraulic systems. Crashworthy features include self-sealing fuel tanks with nitrogen gas inerting, an antiplowing nose structure, energy absorbing landing gear and seats, and crashworthy cargo restraints. Chemical, biological, and radiological (CBR) protection includes cockpit and cabin overpressurization, a contaminant filtration system, and airframe materials selected to facilitate effective decontamination. In addition, the Osprey is designed with an integrated electronic warfare defensive suite including a radar warning receiver, a missile warning set, and a countermeasures dispensing system.

The CV-22 Osprey will be equipped with the Directional Infrared Countermeasures (DIRCM) system. The DIRCM system will work in conjunction with other onboard self-protection systems to enhance the aircraft's survivability against currently deployed infrared guided missiles

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Limitation: - Susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery

Performance

Category(ies)	Data
Armament/Payload	Machine-guns/Mini-guns for suppression fire Up to 20,000 lbs of cargo; up to 24 combat-equipped troops
Ceiling	26,000 feet
Combat Radius	500 NM
Crew	Five (two pilots, a navigator, flight engineer, and loadmaster)
Dimensions	Length: 57 feet, fuselage Span: 38 feet diameter/proprotor, 85 feet rotors Height: 22 feet
Max T/O Weight	Gross - 34,900 lbs VTO - 52,870 lbs STO - 57,000 lbs
Powerplant	2 Rolls Royce Allison AE1107C turboshaft
Range	1800 NM
Speed	100 knots (helo); 314 knots (aero)

System: HC-130P

Category: Strike
Function(s):
Combat Search and Rescue

Long Description: The HC-130P deploys worldwide to provide combat search and rescue coverage for U.S. and allied forces. Combat search and rescue missions include flying low-level, preferably aided at night with night vision goggles, to an objective area where aerial refueling of a rescue helicopter is performed or pararescuemen are deployed. The secondary mission of the HC-130P is peacetime search and rescue. HC-130P aircraft and crews are uniquely trained and equipped for search and rescue in all types of terrain including arctic, mountain, and maritime. Peacetime search and rescue missions may include searching for downed or missing aircraft, sinking or missing ships, and missing persons. The HC-130P can deploy pararescuemen to a survivor, escort a helicopter to a survivor, or airdrop survival equipment to a survivor.

Limitation:
- Relatively slow and unmaneuverable, making it vulnerable if identified
- Large platform makes for relatively easy identification
- Peak performance limited to night operations
- Restricted to none-to low-threat environments

Performance

Category(ies)	Data
Ceiling	33,000 ft
Crew	Eight: pilot, co-pilot, primary navigator, secondary navigator, flight engineer, communications systems operator, and two loadmasters
Dimensions	Length: 99 feet Wingspan: 133 feet Height: 39 feet
Max T/O Weight	155,000 lbs
Powerplant	Four Allison T56-A-15 turboprop engines
Range	4,000 NM
Speed	251 knots

System: MC-130 E/H Combat Talon I-II

Category: Special Operations Forces (SOF)
Function(s):
- Airlift
- Special Operations Employment

Long Description: The MC-130 E/H Combat Talons are modified C-130s that provide global, day and night, adverse weather capability to air-drop personnel and deliver personnel and equipment to support US and allied Special Operations Forces. Combat Talons are air-refuelable. Their navigation suites include dual ring-laser gyros, mission computers and integrated global positioning system to locate and either land or airdrop on small, unmarked zones with pinpoint accuracy day or night. The C-130 tail is strengthened to allow high speed/low signature airdrop for exfiltration, resupply, psychological operations, and aerial reconnaissance in hostile or denied territory. The primary difference between the MC-130E and MC-130H involves the degree of integration of the mission computers and avionics suite. The Combat Talon I was originally conceived and developed during the 1960s. Although extensively upgraded in the 1980-90s, it still features analog instrumentation and does not fully integrate the sensors and communication suites. The Combat Talon II, designed in the 1980s, features an integrated glass flight deck, which improves crew coordination and reduces the crew complement by two.

MC-130 E (Combat Talon I): The modified C-130 E is equipped to air refuel helicopters, plays a vital role in psychological operations, and has a secondary mission in CSAR.

MC-130H (Combat Talon II): The MC-130H upgrade has an integrated glass cockpit compatible with NVGs and improved IR and electronic countermeasures to support unconventional warfare units.

The MC-130 E/H will be equipped with the Directional Infrared Countermeasures (DIRCM) system. The DIRCM system will work in conjunction with other onboard self-protection systems to enhance the aircraft's survivability against currently deployed infrared guided missiles.

Limitation: - High radar cross section makes the MC-130 vulnerable to anti-aircraft weaponry

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Performance

Category(ies)	Data

Armament/Payload	E: 53 troops or 26 paratroops H: 77 trooops or 52 paratroops or 57 litters
Ceiling	30,000 feet
Crew	E: crew of 9 H: crew of 7
Dimensions	Length: 100 feet Span: 133 feet Height: 38.5 feet
Max T/O Weight	155,000 lbs empty: 72,900
Powerplant	4 Allison T56-A-15 turboprops
Range	2700 NM
Speed	250 knots max

System: MC-130P Combat Shadow

Category: Special Operations Forces (SOF)
Function(s):
- Air Refueling
- Special Operations Employment

Long Description: The MC-130 Combat Shadow is an air refueling platform used primarily for refueling Special Operations helicopters at low altitudes. The MC-130 flies clandestine or low visibility, low-level missions into politically sensitive or hostile territories and normally flies single or multi-ship missions at night to reduce the probability of detection and/or intercept by airborne threats. Ancillary to its primary air refueling mission, the MC-130 also performs air-drop missions, including Special Operations teams, small bundles, and zodiac and combat rubber raider craft. The Combat Shadow can also perform night-vision goggle takeoffs and landings and can be refueled in-flight to vastly increase range.

The MC-130 has been modified to enhance navigation, communications, threat detection, and countermeasures. Fully modified, the Combat Shadow has a fully integrated inertial navigation and global positions system and night-vision goggle-compatible interior and exterior lighting. It also has a forward-looking infrared radar, missile and radar warning receivers, chaff and flare dispensers and night-vision goggle compatible heads-up display. Additionally, the MC-130P has satellite and data burst communications. These modifications were completed in FY1999.

Originally designated as the HC-130 N/P, Air Force Special Operations aircraft were changed in February 1996 to align the aircraft with all other M-series Special Operations mission aircraft. First flown in 1964, the aircraft has served many roles and missions. The aircraft was initially modified to conduct search and rescue missions, provide a command and control platform, air refuel helicopters and carry supplemental fuel for extending range or air refueling. MC-130Ps have been a part of the special operations mission since the mid-1980s. They deployed to Saudi Arabia and Turkey in support of Desert Storm in 1990 to provide air refueling of Special Operations Forces' helicopters over friendly and hostile territory as well as psychological operations and leaflet drops.

Limitation:
- Relatively slow and unmaneuverable, making it vulnerable if identified
- Large platform makes for relatively easy identification
- Peak performance limited to night operations
- Restricted to none to low-threat environments

Performance

Category(ies)	Data
Ceiling	30,000 feet
Crew	Eight (pilot, co-pilot, right navigator, and left navigator, flight engineer, communications systems operator, and two loadmasters)
Dimensions	Length: 99 feet Span: 133 feet Height: 39 feet
Max T/O Weight	155,000 lbs
Powerplant	Four Allison T56-1-15 turboprop engines
Range	> 4,000 NM
Speed	251 knots

System: A/OA-10A Thunderbolt II

Category: Strike
Function(s):
- Combat Search and Rescue
- Counterland

Long Description: The A-10 Thunderbolt is specifically designed for close air support of ground forces. It is a simple, effective and survivable twin-engine jet aircraft that can be used against all ground targets, including tanks and other armored vehicles. The A-10 has excellent maneuverability at low air speeds and altitude and is a highly accurate weapons-delivery platform. It can loiter near battle areas for extended periods of time and operate under 1,000 foot ceilings with 1.5 mile visibility. The A-10's wide combat radius and short takeoff and landing capability permits operations in and out of locations near front lines. Using night vision goggles, an A-10 pilot can conduct missions during darkness.

The pilot is encircled by titanium armor that also protects parts of the flight control system. The redundant primary structural sections allow the aircraft to enjoy better survivability during close air support and survive direct hits from armor-piercing and high-explosive projectiles up to 23mm. The self-sealing fuel cells are protected by internal and external foam.

Avionics equipment includes communications, inertial navigation systems, fire control and weapons delivery systems, target penetration aids, and night vision goggles. The weapons-delivery system includes head-up displays that indicate airspeed, altitude, and dive angle on the windscreen; a low altitude safety and targeting enhancement system that provides constantly computing impact point freefall ordnance delivery; and Pave Penny laser-tracking pods under the fuselage. The A-10 also has armament control panels and infrared and electronic countermeasures to handle surface-to-air missile threats.

The Thunderbolt's 30mm GAU-8/A Gatling gun can fire 3,900 rounds a minute and can defeat an array of ground targets to include tanks.

Limitation:
- Susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery
- Slow speed

Performance

Category(ies)	Data
Armament/Payload	one 30 mm GAU-8/A gun; eight underwing hard points and three under fuselage for up to 16,000 lb ordnance; free fall or guided bombs; combined effects munitions dispensers; gun pods; 6 AGM-65 Mavericks; 4 AIM-9 Sidewinder and jammer pods. Chaff and flares carried internally to counter radar-directed or infrared-directed threats. The centerline pylon and the two flanking fuselage pylons cannot be occupied simultaneously.
Ceiling	37,000 feet
Combat Radius	288 NM with 9,500 lb weapons and 1.7 hr loiter
Crew	One pilot
Dimensions	Length: 53 feet Span: 58 feet Height: 15 feet
Max T/O Weight	51,000 ft Empty Weight: 51,000
Powerplant	Two GE TF34-GE-100 turbofans
Range	695 NM
Speed	Cruise: 365 knots

System: F/A-22 Raptor

Category: Strike
Function(s):
- Counterair
- Counterland
- Countersea

Long Description:

The F/A-22 is an advanced air superiority fighter designed to provide a first-look, first-launch, and first-kill capability. The aircraft is designed to reduce radar reflectivity, heat signature, and electronic emissions, giving it a stealth capability. This capability greatly increases the survivability of the aircraft. The F/A-22's primary role is air-to-air, with a secondary air-to-ground role.

The F/A-22 is powered by two Pratt & Whitney F119-PW-100 augmented turbofan engines that include integrated flight-propulsion controls and two-dimensional, thrust-vectoring engine nozzles. This power plant allows the aircraft to cruise efficiently at supersonic airspeeds without using the afterburner. Operating speeds range from Mach 1.6 at supercruise to Mach 2.5 with afterburner. The F/A-22 also enjoys extremely high maneuverability due to a sophisticated aero-design and high thrust-to-weight ratio. The crew consists of one pilot.

Advanced integrated avionics and weapon systems allow the F/A-22 to engage multiple targets simultaneously, allowing the pilot to fly the aircraft as well as search for its next target. The F/A-22 is equipped with a Joint Tactical Information Distribution System (JTIDS) which allows it to receive changes in mission or new target information from off-board sensors such as the HAE UAV or the E-3 AWACS while maintaining electronic silence. Additionally, F/A-22 avionics systems communicate with each other, allowing all members of a flight to share information on the air battle or with AWACS to augment its battle management capability. The advanced avionics and ability to data-link with AWACS and other F/A-22s can provide a very effective all-weather defense against cruise missiles. The F/A-22's radar is designed to find stealthy targets, including stealthy cruise missiles that have reduced radar cross sections.

Sensor Fusion: The F/A-22 intergrates information from a vast range of onboard and offboard sensors. Data can come from AWACS, satellites, wingmen, datalink, ground-based radars and command and control centers. On-board mission avionics process the information and quickly display a clear picture of the tactical situation to the pilot, optimizing fire-control solutions and weapons-engagement zones.

The F/A-22 is capable of deep air interdiction, as well as attacking and destroying enemy aircraft while they are still forming within heavily guarded enemy territory. The Raptor's air-to-surface capability allows for air-defense suppression and other ground attack missions. This platform provides electronic reconnaissance by penetrating well defended territory and gathering and relaying electronic intelligence and can receive mission updates or target information from off-board sensors (e.g., HAE UAV). The Raptor combats low-observable cruise missiles and pinpoints locations of enemy headquarters and/or targets for other platforms. It also has the capability to extend/augment the electronic range of sensors using its advanced electronics suite.

The F/A-22 is Link-16 compatible.

The Air Force may add a modified version of the F/A-22 to the inventory, designated the FB-22. The platform serves as a strike aircraft with a stretched F/A-22 body to accommodate longer weapons bays. The longer bays could hold two JDAM in line astern, and the side bays could accommodate AIM-120s. FB-22s would likely have a 14-meter wingspan to fit into a standard hardened aircraft shelter, extended range, and possibly a tailless design. The FB-22 would be used for the air-to-surface missions.

Limitation: - To increase armament, munitions must be carried externally, which reduces effectiveness of stealth design.

Performance

Category(ies)	Data
Armament/Payload	Air-to-Air loadout: three weapons bays. In a standard air-to-air configuration, each side bay carries one AIM-9X Sidewinder air-to-air missiles with six AIM-120 Advanced Medium Range Air-to-Air Missiles (AMRAAM) in the main center bay (for a total of 8 munitions). In a ground attack variant, two JDAM-1000 Precision Guided Munitions or two small Hypervelocity Missiles would be carried in the main weapons bay, in addition to the two AIM-9X Sidewinders and two AMRAAMs. It is also possible to carry 4 JDAMs and no other munitions. Provisions exist for external carriage of munitions. The Advanced 27mm Aircraft Cannon is a gas-operated, automatic revolver gun that can fire either high-explosive, dual-purpose rounds, or armor-piercing incendiary rounds. Air-to-Air: (2) AIM 9M/X (6) AIM-120C Air-to-Ground: (2) AIM 9M/X (2) AIM-120C (2) 1000-lb JDAM WASAAMM 8 Small Diameter Bombs (6/bay) External Carriage:(2) AIM 9M/X (6) AIM-120C (2) Fuel Tanks (600 gal.) (6) AIM-120/ AIM 9
Ceiling	50,000 feet
Combat Radius	322 + 100 NM
Crew	One Pilot
Dimensions	Height: 16'5" Wingspan: 44'6"

	Length: 62'1"
Max T/O Weight	60,000 lbs.
Powerplant	2 Pratt & Whitney F119-PW-100 Turbofan engines
Range	1800 NM with external tanks
Speed	Penetration Speed: 1100 knots Cruise Speed: 550 knots

System: F-15 Eagle

Category: Strike
Function(s):
Counterair

Long Description: The F-15C Eagle is an all-weather, extremely maneuverable, tactical fighter designed to gain and maintain air superiority in aerial combat. It possesses electronic systems and weaponry to detect, acquire, track, and attack enemy aircraft while operating at great distances.

The F-15 provides a mixture of outstanding maneuverability and acceleration, range, weapons and avionics to achieve air superiority. The F-15's superior maneuverability and acceleration are achieved through high engine thrust-to-weight ratio and low wing loading that enables the aircraft to turn tightly without losing airspeed. The Eagle's state-of-the-art multimission avionics system includes a heads-up display, advanced radar, inertial navigation system, flight instruments, UHF communications, tactical navigation system, and instrument landing system. In addition, it has an internally mounted tactical electronic-warfare system, "identification friend or foe" system, electronic countermeasures set, and a central digital computer. The F-15's versatile pulse-Doppler radar system can look up at high-flying targets and down at low-flying targets without being confused by ground clutter. The radar feeds target information into the central computer for effective weapons delivery. For close-in dogfights, the radar automatically acquires enemy aircraft, and this information is projected on the heads-up display. An inertial navigation system enables the Eagle to navigate anywhere in the world.

The F-15 can be armed with combinations of different air-to-air weapons: (4) AIM-7 or AIM-120s on its lower fuselage corners, (4)AIM-9, AIM-9X Sidewinder+ or AIM-120 missiles on two pylons under the wings, and an internal 20mm Gattling gun (with 940 rounds of ammunition) in the right wing root. Low-drag, conformal fuel tanks were especially developed for the F-15C and D models. These tanks reduce the need for in-flight refueling on global missions and increase time in the combat area.

The F-15 Eagle possesses a significant close-in combat maneuvering ability with foreign fighters and is capable of multimission tasking. The F-15 escorts non-stealthy bomber platforms and is used with F/A-22s, F-16s, F-35's, surface-to-air missiles, and other systems to achieve and maintain air superiority. It employs GPS III and AWACS to get mission updates and course correction in-flight.

The F-15 Eagle is Link-16 capable.

Limitation: - Susceptible to surface-to-air missiles, air-to-air missiles, and anti-aircraft artillery

Performance

Category(ies)	Data
Armament/Payload	One internally mounted M-61A1 20mm, six-barrel cannon with 940 rounds of ammunition; four AIM-9L/M Sidewinder and four AIM-7F/M Sparrow air-to-air missiles, or eight AIM-120 AMRAAMs, carried externally; 8 AIM-9X Sidewinders
Ceiling	65,000 ft
Combat Radius	600 NM, with max 1000 NM with Conformal Fuel Tanks
Crew	F-15A/C: one; F-15B/D: two
Dimensions	Length: 64 feet Span: 43 feet Height: 19 feet
Max T/O Weight	68,000 lbs Empty - 28,600 lbs
Powerplant	Two Pratt & Whitney F100-PW-100 turbofan
Range	1700 NM 2900 NM ferry range w/ external tanks
Speed	Max: Mach 2.5 Cruise: 480 knots

System: F-15E Strike Eagle

Category: Strike
Function(s):
- Counterair
- Counterland
- Countersea

Long Description: The F-15E is a two-seat, dual-role, integrated fighter/bomber for all-weather, air-to-air, and deep interdiction missions. It is externally and dimensionally similar to the two-seat F-15D. However, the F-15E is internally redesigned with a stronger structure so that it can safely operate at takeoff weights as great as 81,000 lbs.

The heart of the F-15E's electronics suite is the AN/APG-70 radar. The radar can be quickly switched on to obtain a single-sweep synthetic aperture radar image of a target area located as much as 45 degrees to either side of the aircraft's flight path, then rapidly switched off seconds later, making it difficult for an enemy to pick up the emissions and track the F-15E's location and flight path. The radar map can be 'frozen' on the screen and updated periodically by new sweeps as the aircraft gets nearer to the target. Roads, bridges, and airfields can be identified as far as 100 miles away.

Another key element of the F-15E's weapons-delivery system is the Low-Altitude Navigation and Targeting, Infra-Red for Night (LANTIRN) system, which consists of two pods, one carried underneath each air intake. The starboard pod is used for navigation and contains a Forward-Looking, Infra-Red camera (FLIR) that can be used to display a high-quality video image of the oncoming terrain on the pilot's heads-up display, enabling high-speed, low-level flights to be made at night under clear weather conditions. The port pod is a targeting pod that contains a high-resolution tracking FLIR, a missile boresight correlator, and a laser designator. The boresight correlator is used to guide the Maverick air-to-surface missile, and the laser designator is used for such weapons as laser-guided bombs that home in on reflected laser light.

In addition to a 20mm M61A1 rotary cannon with 512 rounds, the F-15E is capable of carrying up to 23,500 lbs. of ordnance for ground-attack missions. For air-to-air missions, the aircraft carries up to eight of a combination of AIM-7F/M Sparrow missiles, AIM-9L/M Sidewinder missiles, or AIM-120 AMRAAM missiles.

The Strike Eagle provides a ground-strike, deep-interdiction capability and is capable of performing air superiority missions. It utilizes an on-board electronic defensive suite to increase survivability. The F-15E provides bomber escort and can be used with

naval-launched cruise missiles to strike high value targets. It utilizes GPS III for course correction during flight and works in conjunction with JSTARS and AWACS to get mission updates and course correction during flight. It is also used with surface-to-air missiles in defense of high value U.S. targets and resources, and supports overall Offensive Counter Air (OCA) efforts, Defensive Counter Air (DCA) efforts, and Suppression of Enemy Air Defense (SEAD) missions.

The F-15E is Link-16 compatible

Limitation: - Susceptible to advanced surface-to-air missiles, air-to-air missiles, anti-aircraft artillery, and jamming
- Non-stealthy airframe

Performance

Category(ies)	Data
Armament/Payload	One 20mm M61A1 rotary cannon with 512 rounds. Ground Attack: 23,500 lbs. of stores, including 5 JDAMs, 5 JSOWs or 3 JASSMs. Air-to-Air: a combination of up to eight AIM-9 or AIM-9X Sidewinders, AIM-7 Sparrow missiles, and AMRAAM missiles. The F-15E can carry any air-to-surface weapon in the Air Force inventory (nuclear and conventional).
Ceiling	50,000 feet
Combat Radius	910 NM (Hi - Med - Hi profile)
Crew	Two
Dimensions	Length: 64 feet Span: 43 feet Height: 18.5 feet
Max T/O Weight	81,000 lbs; Empty - 45,000 lbs
Powerplant	Two Pratt & Whitney F100-PW-220
Range	2600 NM ferry range with CFT's
Speed	Max: Mach 2.5 at 40,000 ft for short dash Cruise: 480 knots

System: F-16 Fighting Falcon

Category: Strike
Function(s):
- Counterair
- Counterland
- Countersea

Long Description:

The F-16 is a lightweight, single-engine, high-performance, multi-mission tactical fighter. This aircraft can perform precision strike, night attack, and beyond-visual-range interception missions. The F-16 can locate targets in all weather conditions and detect low-flying aircraft in radar ground clutter. In an air-to-surface role, the F-16 can fly more than 500 miles (860 km), deliver its weapons with accuracy, defend itself against enemy aircraft, and return to its starting point. The F-16's all-weather capability permits it to accurately deliver ordnance during non-visual bombing conditions, and the F-16 can withstand up to 9 Gs with internal fuel tanks filled.

The cockpit and bubble canopy gives the pilot unobstructed forward and upward vision as well as greatly improved vision over the side and to the rear. The aircraft employs excellent, responsive flight controls enabled through a "fly by wire" system: electrical wires relay commands replacing the usual cables and linkage controls. Avionics systems include a highly accurate inertial navigation system where a computer provides steering information to the pilot. The F-16 has UHF and VHF radios plus an instrument landing system. The F-16 also has a warning system and modular countermeasure pods to be used against airborne or surface electronic threats. The fuselage has space for additional avionics systems. The F-16A & F-16C are one-seater aircraft; F-16B & F-16D variants are two-seaters.

Most active units use F-16Cs & F-16Ds, which come in Block 40 (CG) and Block 50 (CJ) variants. Block 40 F-16s are primarily used to deliver Precision Guided Munitions (PGMs), while Block 50s are used primarily in a SEAD role to deliver HARMs. The Block 40 CG is equipped with the LANTIRN pods for all-weather targeting for precision guided munitions (PGM).

The F-16 supports overall Offensive Counter Air (OCA) and Defensive Counter Air (DCA) efforts to achieve air superiority, and, in conjunction with other close air support assets, supports efforts of friendly forces on the FEBA; day or night and all weather.

The F-16 is Link-16 compatible.

Limitation:	- Susceptible to late-model surface-to-air missiles, advanced air-to-air missiles, and anti-aircraft artillery - Extensive foreign military sales & production programs; proliferated knowledge of weaknesses - Short combat radius relative to current and projected missions - Non-stealthy airframe decreases overall survivability in future threat environments - Limited payload

Performance

Category(ies)	Data
Armament/Payload	Gun: One 20 mm M61A1 Vulcan cannon (511 rds) Mountings: 7 to 9 external hardpoints and 2 wingtip rails Air-to-Air Missile: AIM-7 Sparrow/Skyflash (3 per wing), AIM-9/9x Sidewinder (3 per wing), AIM-120 AMRAAM (4 per wing), AIM-132 ASRAAM, Magic II or MICA Air-to-Surface Missile: AGM-45 Shrike, AGM-65 Maveric, AGM-88 HARM, AGM-84 Harpoon, AGM-119 Penguin, BLU-107 Durandal, Wasp, AS30L (5 per wing, with one triplet launcher fitted to 3 and 7 station and single weapon fitted to 3, 4, 6 and 7 station.). 2 JASSMs (on C/D variant) Bomb: GBU-10/12/15/24 Paveway LGB, B43 nuclear, Mk 82/83/84 GP (6), Rockeye, CBU-52/58/71/87/89/97 cluster, BL-755, BSU-49/50, BLU-109, Mk 36 Destructor Other: ECM pods, navigation pods, targeting pods, rocket pods, gun pods, autonomous free-flight dispenser system
Ceiling	50,000 feet
Combat Radius	575 NM, hi-lo-lo-hi
Crew	One Pilot
Dimensions	Length: 49 feet Span: 33 feet, with missiles Height: 17 feet
Max T/O Weight	Block 40/42: 42,000 lbs C Empty: 18,600 - 18,900 lbs
Powerplant	1 Pratt & Whitney F100-PW-200/220 or GE F-110-GE-100 turbofan engine with afterburner Block 50: F110-GE-129 Block 52: F100-PW-229
Range	1740 NM
Speed	Max: Mach 2 Cruise: 480 knots

System: F-35A Joint Strike Fighter

Category: Strike
Function(s):
- Counterair
- Counterland
- Countersea

Long Description:

The F-35A Joint Strike Fighter is a multi-role, strike aircraft providing high-lethality, maneuverability, survivability, and maintainability. Central to the airplane's design are commonality and modularity and low-speed handling qualities. Each of these characteristics make it capable of performing the air-to-air and air-to-ground needs of the Air Force, Navy, and Marine Corps. The aircraft is designed to capitalize on stealth technology to make it less visible to enemy radar. The USAF's F-35 variant is a multi-role (primary-air-to-ground) conventional take-off and landing fighter to replace the F-16 and A-10, and to complement the F/A-22.

The F-35A is powered by a derivative of the Pratt & Whitney F119 engine. These engines produce over 35,000 lbs of thrust, giving the F-35A an extremely high thrust-to-weight ratio. Adjustable thrust vectoring nozzles on the engines further enhance maneuverability. Advanced integrated avionics and weapons systems, driven by integrated subsystems, facilitate targeting and defensive operations, allowing the pilot to accomplish these tasks with reduced effort. A Multi-Function Integrated Radio Frequency System (MIRFS) integrates radar, electronic warfare, and communications functions into a single array.

F-35A employs a new generation of radar with active electronically scanned array (AESA) for scanning and tracking targets. The AESA antenna can see aircraft at much greater ranges and accuracy than with standard EW warfare systems, and can simultaneously perform jamming, electronic spying, communications, and other tasks. Data collected by the AESA is fused with information from off-board sources (AWACS, JSTARS, Rivet Joint, satellites) and on-board electro-optical systems which, when combined, enable mapping, striking, and jamming. With more than 10 times the bandwidth of conventional radar systems, the F-35A radar has increased capability for jamming missile and anti-aircraft artillery threats. The radar system also supports weapons that are already in flight by sending air- or ground-target position updates through a data link. F-35A utilizes an automatic target recognition/classification system capable of finding targets at 90 nm or greater with a high-pulse repetition frequency (PRF) waveform that allows detection of targets through background clutter and eliminates range ambiguities.

F-35A's electro-optical targeting system (EOTS) is a single-aperture device with an advanced low profile that fits into the aircraft nose between the radome and the front wheel well. The sensor works full-time with the integrated RF radar system, cross-cueing to maintain better situational awareness. EOTS significantly increases the range at which the infrared system can passively locate and track helicopters, aircraft, and missiles, in the hemisphere beneath the aircraft. The wide aperture allows the associated laser range finder and designator to stay focused on the target even while the F-35A is turning away.

The F-35A's air-to-surface capability allows for air defense suppression and other ground attack missions. Its air-to-air capability increases the versatility of the aircraft, making it capable of multi-role missions. The F-35A has the ability to operate at low speeds in support of Close Air Support (CAS) missions. Stealthy characteristics enable deep interdiction missions. An advanced sensor suite allows F-35A to perform battle damage assessment, intelligence, and reconnaissance missions. The F-35A extends and/or augments the C4ISR capability of other systems through the production and transmission of real-time information out of the cockpit.

The F-35A is Link-16 compatible.

Limitation: - To increase armament, munitions must be carried externally, which reduces effectiveness of stealthy design

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Performance

Category(ies)	Data
Armament/Payload	Two air-to-air missiles and two 2,000 lb class precision air-to-surface weapons AND four 2,000 lb class precision air-to-surface (external) Two 2,000-pound class precision air-to-surface weapons carried internally, or six JDAMs. Internal Mauser BK-27 advanced gun system is a gas-operated, automatic revolver gun that can fire either high-explosive, dual-purpose rounds, or armor-piercing incendiary rounds. Internal Carriage Capability: GBU-31 (JDAM), GBU-32, Mk-83 LDGP, 4 x Mk-82 LDGP, Miniature Munitions Capability, MALD, JAWS/Modernized Hellfire, Laser-Guided Training Round, Reconnaissance Package, AIM-9X, BDU-22, Mk-106, Mk-84, Internal Fuel Tanks (300 Gallons) 8 SDB's
Ceiling	TBD - est. 40,000 feet
Combat Radius	USAF: 679 NM USN: 690 NM VSTOL: 518 NM
Crew	One Pilot
Dimensions	Length: 50.5 feet Span: 33 feet Height: 15 feet
Max T/O Weight	TBD
Powerplant	Pratt & Whitney F135 or GE F136
Range	1300 NM
Speed	USAF: > Mach 1 USN: 630 knots VSTOL: 630 knots

Cruise: 480 knots

System: UAV Joint Unmanned Combat Air System (J-UCAS)

Category: Strike
Function(s):
- Counterair
- Counterinformation
- Counterland

Long Description: The J-UCAS is a highly survivable unmanned aircraft designed to attack targets at any location within the enemy battlespace. The J-UCAS utilizes its stealthy design and precision weapons to engage and destroy heavily defended, relocatable time-critical and/or high value targets day or night in any weather. One of the primary missions for the J-UCAS is the SEAD/DEAD mission in a preemptive, reactive, and/or escort role. The J-UCAS carries a variety of kinetic weapons, and may be equipped with electronic attack payloads to provide a stand-in jamming adaptability. Another key mission area for the J-UCAS is persistent penetrating ISR, precision targeting and battle damage assessment (BDA) using an internal spot synthetic aperture radar (SAR) and an advanced multi-ship electronic support measures (ESM) package. These sensors give the commander the ability to attack highly specialized or difficult targets, capitalizing on extremely low IR, acoustic, electromagnetic, and visual signatures to avoid detection. However, to avoid degradation of stealth capabilities from sensor emissions, the optimal J-UCAS employment would use external sensors for ISR, target cueing, and BDA.

The J-UCAS is self-deployable with an air refueling capability to extend range/combat radius. The mission control function is typically performed at a mission control station that may be co-located with the AOC. Potentially, the J-UCASs may be controlled by airborne C2 platforms. One operator is responsible for launch and recovery. Once the J-UCAS is airborne, another operator assumes control for mission execution, monitoring up to four J-UCASs at one time. The J-UCAS is designed for varying degrees of autonomous operation, as determined by the rules of engagement (ROE) and specific tasking. In its highest state of autonomy, the J-UCAS executes mission profiles, processes a combination of internal and external data, automatically locates/engages targets, and egresses the battlespace. At the opposite end of the continuum, an operator in the command center can also control J-UCAS. In all cases (even fully autonomous mode), a "man in the loop" capability will be available.

High Power Microwave (HPM) Payload
The J-UCAS DE payload is a specialized weapon module designed to defeat high value electronic targets with High Power Microwave (HPM) electromagnetic radiation. HPM systems defeat electronic-based systems by "flashing" them with very high power bursts

of microwaves, causing physical damage to electronic components. A typical HPM engagement involves ingress to the target area, descent to the engagement altitude, and engaging the target (typically for less than one second) by directing the HPM beam (which has a <10 degree spread) at the target when the J-UCAS is parallel.

Limitation:
- Command and control may be vulnerable to jamming or spoofing
- On-board sensor emissions reduce stealthiness
- Limited engagement range of HPM attack increases exposure to SAMs and AAA

Performance

Category(ies)	Data
Armament/Payload/Sensor	Sensors: EO, IR, SAR, Hyperspectral (HSI). Weapons: 12 SDB, 12 WASAAMM, 4 HARM, 2 JDAM, 2 WCMD, 4 Multiband integrated aperture jamming transmitter Note: Weapon payload is split between two bays, allowing for UCAV to mix munitions (e.g. one JDAM, 6 SDB's).
Ceiling	45,000 feet
Range	Combat Radius: 1200 nm with 2 hrs persistence in AO unrefueled (air refuelable)
Speed	Cruise Speed: Mach .85
Weight	Empty weight 36,000 lbs, max T/O weight 41,500 lbs

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